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GB 2291244 A GB 2260209 A GB 2222710 A
WO 87/02812 A1 US 4833489 A

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(54) Proximity warning device

(57) A proximity warning device 10 includes a telemetry device 12 which measures the distance between an equipped vehicle 11 and a vehicle 27 trailing the equipped vehicle, a warning light 16 visible from a trailing vehicle 27 and a logic circuit 14 connected to the warning light 16 and the telemetry device 12. The logic circuit 14 receives the measured separation distance from the telemetry device 12 and the equipped vehicle's speed as ascertained from its speedometer. The logic circuit 14 then determines the minimum safe separation distance based upon the equipped vehicle's speed. If the measured separation distance is less than the minimum safe separation distance then the logic circuit 14 causes the warning light 16 to be illuminated to alert the driver of the trailing vehicle that he is following too closely. The telemetry device 12 may employ ultrasonic or electromagnetic waves.

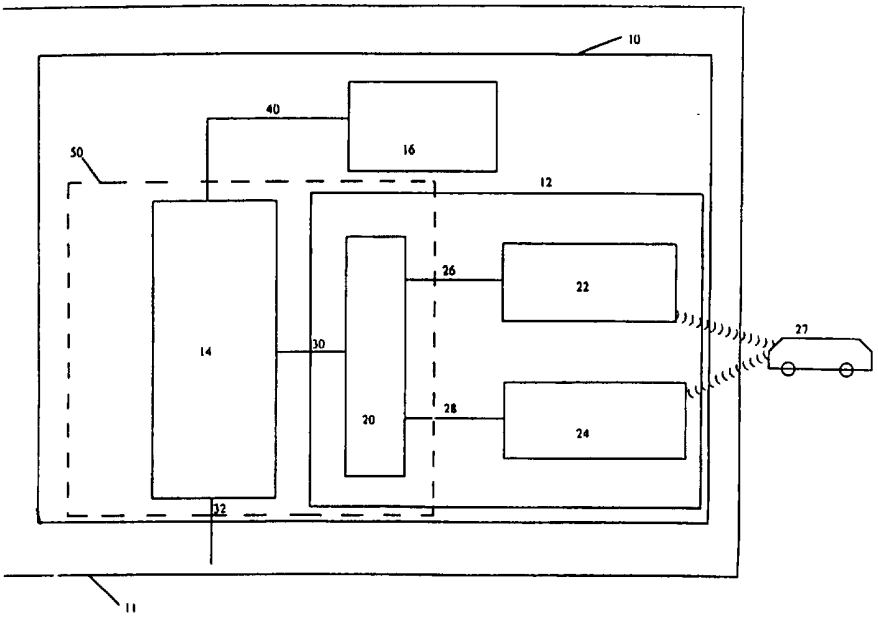

FIG. 1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

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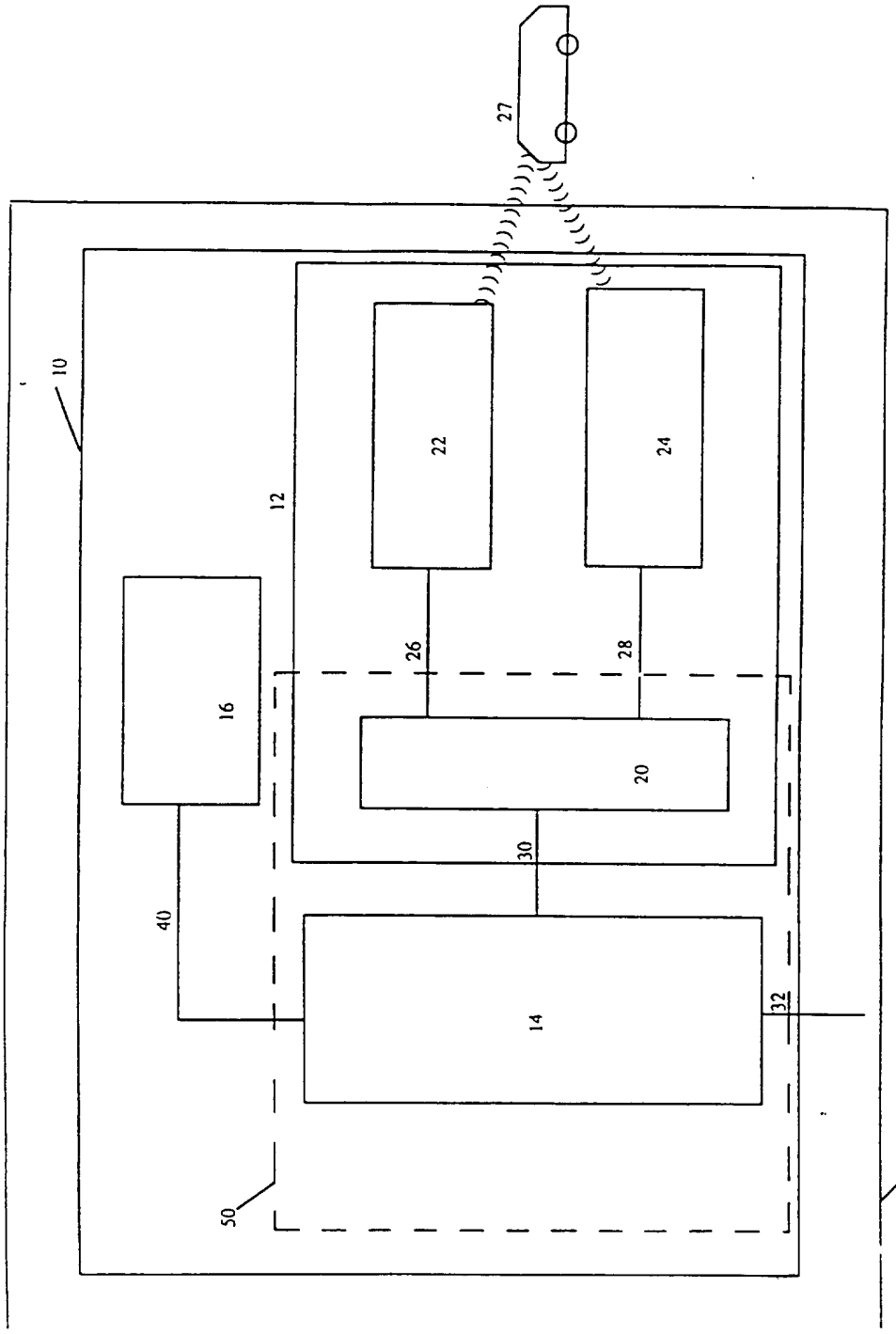

FIG. 1

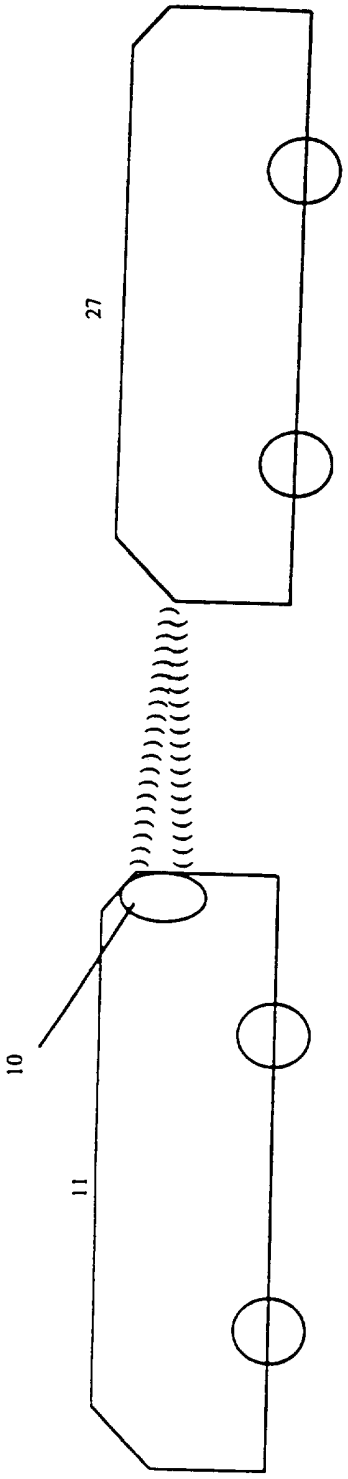

FIG. 2

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PROXIMITY WARNING DEVICE

Technical Field

This invention relates to a distance warning device for motor vehicles. More particularly the invention relates to a proximity warning device for mounting to a vehicle which measures the spacing between the equipped vehicle and a trailing vehicle, compares the measured spacing against the minimum safe distance for the speed at which the equipped vehicle is traveling, and provides the driver of the trailing vehicle a visual indication if he or she is following too closely.

Background of the Invention

One of the most common types of vehicle accidents is the rear-end collision. Rear-end collisions are generally due to a failure by the driver of a trailing vehicle to maintain a sufficient distance between the trailing vehicle and the leading vehicle to provide for safe stopping. It is sometimes difficult for the driver to ascertain the proper following distance necessary to accommodate a sudden or even gradual stop by the leading vehicle. Also, many such collisions occur during peak traffic times, i.e. "rush hour," when drivers thoughts may not be fully focused on driving.

Many rear-end collisions could be avoided if the driver of the trailing vehicle was aware of the fact that he or she was following too closely and simply increased the separation between the driver's car and the immediately preceding car. The driver of a leading vehicle may realize that he is in danger of being hit by a trailing vehicle that is following too closely, but the driver has no way to alert the trailing vehicle to slow down. Thus there is a need for a device that will enable a driver of a leading vehicle to warn the driver of a trailing vehicle that the trailing vehicle is following too closely.

The safe stopping or vehicle separation distance is generally dependent upon the reaction time of the driver of the trailing vehicle and the time and space required to reduce the speed. The time needed to stop or reduce the speed is a function of the speeds at which both of the vehicles are traveling. Many other factors also affect the time and distance necessary to stop a car and safely avoid a rear-end collision. Such factors include the road surface and slope, the car weight, the weather conditions, and the condition of the car's brakes and tires.

Because of the numerous variable factors, it is very difficult to specify a proper distance between cars at any given time. Because vehicle speed is the only factor which can be readily ascertained, many motor vehicles safety departments and other safety organizations have established formulas for determining the recommended safe spacing between vehicles which are based only on the speed of the vehicles.

However, even if the only necessary variable, speed, is known by a driver, it is unlikely that the driver would be able or willing to perform the calculation to arrive at the recommended safe distance between cars. Also, many drivers are not able to accurately estimate the distance to a vehicle in front of them. Thus there is a need for a device that will measure the actual distance between two vehicles and compare that distance to the safe separation distance between the two vehicles and provide a warning to the driver of a trailing vehicle if she or he is following the leading vehicle too closely. There is a further need

for a proximity or safe distance warning system that will ascertain the safe distance between vehicles and then visually warn the driver of the trailing vehicle that he should slow down to allow for more distance between the vehicles.

Summary of the Invention

Stated generally, the present invention comprises a device that will enable a driver of a leading vehicle to warn the driver of a trailing vehicle that the trailing vehicle is following too closely. The device measures the actual distance between two vehicles, then compares that distance to the safe separation distance between the two vehicles, and provides a visual warning to the driver of the trailing vehicle if she or he is following the leading vehicle too closely.

Stated somewhat more specifically, the present invention comprises a proximity warning device consisting of a telemetry device which measures the distance between an equipped vehicle and a vehicle trailing the equipped vehicle. A logic circuit is connected to the telemetry device which receives the measured separation distance and the equipped vehicle's speed as ascertained from the equipped vehicle's speedometer. The logic circuit then determines the minimum safe vehicle separation distance based upon the equipped vehicle's speed and compares the minimum safe separation distance to the measured separation distance. If the measured separation distance is less than the minimum safe separation distance, the logic circuit causes a warning light to become illuminated to provide a warning signal to the driver of the trailing vehicle, such that the driver of the trailing vehicle is alerted that he is following the equipped vehicle too closely.

In the preferred embodiment, the warning signal is an amber light and the telemeter, the warning signal. and the logic circuit are housed in a single stand-alone unit. The telemeter may be a sonar or an electromagnetic wave distance measuring device. The logic circuit is a central processing unit or a processing unit

cable of receiving multiple data and manipulating that data in a series of functions.

Accordingly, it is an object of the present invention to provide a device that will warn the driver of a trailing vehicle that he is following too closely to the equipped vehicle.

Another object of the present invention is to provide a proximity or safe distance warning system that will ascertain the safe distance between vehicles and if the actual distance is less than the safe distance, then visually warn the driver of the trailing vehicle that he should slow down to increase the distance between the vehicles.

Yet a further object of the present invention is to provide a device that will measure the actual distance between two vehicles and compare that distance to the safe separation distance between the two trailing vehicles and provide a warning to the driver of vehicle if he is following the leading vehicle too closely.

Other objects, features, and advantages of the present invention will become apparent upon reading the following specification, when taken in conjunction with the drawings and the appended claims.

Brief Description of the Drawings

FIG. **1** is a block diagram of the proximity warning device of the present invention.

FIG. **2** is a drawing showing a typical environment in which the present invention is used.

Detailed Description of the Disclosed Embodiment

Referring now to the drawings, in which like numerals indicate like elements throughout the several views, FIG. **1** illustrates a proximity warning device **10** in accordance with the present invention. The proximity warning device is mounted in a vehicle **11**, referred in herein as the equipped vehicle. The proximity warning device **10** comprises three parts: a telemetry device **12**, a logic circuit **14**, and a warning light **16**.

The telemetry device **12** comprises a telemetric converter **20**, an ultrasonic transmitter **22**, and an ultrasonic receiver **24**. The ultrasonic transmitter **22** and the ultrasonic receiver **24** are mounted on the equipped vehicle **11** facing rearward, and are preferably mounted on the rear of the equipped vehicle **11**. The telemetric converter **20** is connected to the ultrasonic transmitter **22** by a signal path **26**. The telemetric converter **20** is connected to the ultrasonic receiver **24** by a signal path **28**.

The telemetry device **12** is connected to the logic circuit **14** by a signal path **30**. The logic circuit **14** is connected to the speedometer of the equipped vehicle **11** by a signal path **32**.

The logic circuit **14** is connected to the warning light **16** by a signal path **40**. It is preferable to connect signal path **40** to a relay, transistor switch or similar device to activate warning light **16**.

Referring now to FIGS. **1** and **2**, the proximity warning device **10** operates as follows. The telemetric converter **20** sends an electronic impulse via signal path **26** to the ultrasonic transmitter **22** that initiates the transmission of a pulsed signal from the ultrasonic transmitter **22**. The pulsed signal is transmitted rearward and reflected off of an object in its path, typically a trailing vehicle **27**. The pulsed signal is then directed back towards the proximity warning device **10** and detected by the ultrasonic receiver **24**.

Upon receipt of the pulsed signal, the ultrasonic receiver **24** sends an electronic impulse via signal path **28** to the telemetric converter **20**. The telemetric converter **20** includes a clock or other timing device that measures the time between the provision of the impulse via signal path **26** and the receipt of the impulse via signal path **28**. The telemetric converter **20** uses the time value to calculate the measured separation distance between the equipped vehicle **11** and the trailing vehicle **27**. The telemetric converter **20** calculates the measured separation distance from the time value according to a predetermined

formula, measured separation distance = (time value x speed of sound) / 2. The telemetric converter **20** transmits the measured separation distance via signal path **30** to the logic circuit **14**.

The logic circuit **14** receives the speed of the equipped vehicle **11** via signal path **32** from the speedometer of the equipped vehicle **11**. The logic circuit **14** then determines the minimum safe separation distance between the equipped vehicle **11** and the trailing vehicle **27**. Preferably, the logic circuit **14** determines the minimum safe separation distance by means of a look-up table, using the speed of the equipped vehicle **11**, such as is shown in the Driver's Handbooks of the various states. The logic circuit **14** may instead arrive at the minimum safe separation distance by calculating the minimum safe separation distance from values of the speed of the equipped vehicle **11** according to a predetermined formula.

The logic circuit **14** then performs a comparison between the measured separation distance and the minimum safe separation distance. If the measured separation distance is less than the minimum safe separation distance, then the logic circuit **14** sends a signal via signal path **40** to the warning light **16** that causes the warning light **16** to be illuminated. If the measured separation distance is equal to or greater than the minimum safe separation distance then no signal is sent via signal path **40** to the warning light **16**.

It is preferable for the telemetry device **10** to be a sonar distance measuring device. However, this invention may also be practiced wherein the telemetry device **10** employs electromagnetic waves such as laser, radar or infrared.

Logic circuit **14** and telemetric converter **20** are shown as surrounded by a dashed line **50** in FIG **1**. This indicates that, in the most practical embodiments of the present invention, these two elements will be embodied by circuitry employing a single microprocessor. It is believed that the best mode of implementing the present invention is to use an internal counter/timer in a microprocessor or one-chip microcomputer for measuring the elapsed time between the telemetric converter's

20 provision of the impulse via signal path 26 and the receipt of the impulse via signal path 28.

The look-up table in logic circuit 14 is preferably stored in read only memory of the microprocessor or one-chip microcomputer. The programming for a microprocessor to determine the value of the minimum safe separation distance using the speed of the equipped vehicle 11 and the look up table is readily understood by one skilled in the art. While in the preferred embodiment of the present invention, the logic circuit 14 and telemetric converter 20 are embodied by circuitry employing a single microprocessor, it will be appreciated that the logic circuit 14 and the telemetric converter 20 may be embodied in separate microprocessors or one-chip microcomputers, such that the chip embodying the logic circuit 14 may be easily replaced to account for differing standards of minimum safe separation distances.

Signal path 40 from warning light 16 will preferably be connected to logic circuit 14 at a pin of an input/output port of the microprocessor. Preferably, warning light 16 is amber. Warning light 16 may include written indicia superimposed on warning light 16 requesting the driver of the trailing vehicle 27 to increase the separation distance between the equipped vehicle 11 and the trailing vehicle 27.

The particular devices that embody telemetry device 12, logic circuit 14, and warning light 16, as well as the interconnections for same, are well known by those skilled in the art.

Finally, it will be understood that the preferred embodiment has been disclosed by way of example, and that other modifications may occur to those skilled in the art without departing from the scope and spirit of the appended claims.

CLAIMS

What is claimed is:

1. A proximity warning device comprising:

a telemetry device which measures the distance between an equipped vehicle and a vehicle trailing the equipped vehicle;

a warning light visible from a trailing vehicle; and

a logic circuit connected to said telemetry device which receives the measured separation distance and the equipped vehicle's speed as ascertained from the equipped vehicle's speedometer,

said logic circuit being operative to determine the minimum safe separation distance based upon the equipped vehicle's speed and to compare the minimum safe separation distance to the measured separation distance, and

said logic circuit being operative to illuminate said warning light to provide a warning signal to the driver of the trailing vehicle if the measured separation distance is less than the minimum safe separation distance.

2. The proximity warning device of Claim 1 wherein said telemetry device is a sonar distance measuring device.

3. The proximity warning device of Claim 1 wherein said telemetry device is an electromagnetic wave distance measuring device.

4. The proximity warning device of Claim 1 wherein said warning light includes written indicia superimposed thereon requesting the driver of the trailing vehicle to increase the separation distance between the equipped vehicle and the trailing vehicle.

5. The proximity warning device of Claim 1 wherein said logic circuit includes at least one look-up table for determining said minimum safe separation distance.

6. The proximity warning device of Claim 1 wherein said logic circuit calculates said minimum safe separation distance from values of the equipped vehicle's speed according to a predetermined formula.

7. The proximity warning device of Claim 1 wherein said telemetry device, said logic circuit and said warning light are housed in a single stand-alone unit.

8. A proximity warning device for use in a first vehicle having a speed measuring device for providing a speed signal indicative of said vehicle's speed comprising:

a telemetry device for measuring the distance between said first vehicle and a second trailing vehicle and for providing a measured separation distance;

a logic circuit connected to said speed measuring device and said telemetry device for determining a minimum safe separation distance in response to said speed signal and for comparing said minimum safe separation distance against said measured separation distance and for providing an alarm signal in response to said minimum safe separation distance being less than said measured separation distance; and

a warning light connected to said logic circuit and mounted on said first vehicle so as to be visible to the driver of said second vehicle that is activated to provide a visible warning in response to said alarm signal.

9. The proximity warning device of Claim 8 wherein said telemetry device is a sonar distance measuring device.

10. The proximity warning device of Claim **8** wherein said telemetry device is an electromagnetic wave distance measuring device.

11. The proximity warning device of Claim **8** wherein said warning light includes written indicia superimposed thereon requesting the driver of the second vehicle to increase the separation distance between the first vehicle and the second trailing vehicle.

12. The proximity warning device of Claim **8** wherein said logic circuit includes at least one look-up table for determining said minimum safe separation distance.

13. A proximity warning device of Claim **8** wherein said logic circuit calculates said minimum safe separation distance from values of said speed signal according to a predetermined formula.

14. The proximity warning device of Claim **8** wherein said telemetry device, said logic circuit and said warning light are housed in a single stand-alone unit.

15. A vehicle capable of alerting a driver of a trailing vehicle that the trailing vehicle is following too closely, comprising:

a telemeter mounted to said vehicle which measures the distance between said vehicle and the trailing vehicle;

a warning light mounted on said vehicle so as to be visible from the trailing vehicle; and

a logic circuit connected to said telemeter and operative to receive the measured separation distance and said vehicle's speed as ascertained from said vehicle's speedometer,

said logic circuit being operative to determine the minimum safe vehicle separation distance based upon said vehicle's speed and to compare the minimum safe separation distance to the measured separation distance, and

said logic circuit being operative to illuminate said warning light if the measured separation distance is less than the minimum safe separation distance.

16. The vehicle of Claim **15** wherein said telemetry device is a sonar distance measuring device.

17. The vehicle of Claim **15** wherein said telemetry device is an electromagnetic wave distance measuring device.

18. The vehicle of Claim **15** wherein said warning light includes written indicia superimposed thereon requesting the driver of the trailing vehicle to increase the separation distance between said vehicle and the trailing vehicle.

19. The vehicle of Claim **15** wherein said logic circuit includes at least one look-up table for determining said minimum safe separation distance.

20. A vehicle of Claim 15 wherein said logic circuit calculates said minimum safe separation distance from values of the equipped vehicle's speed according to a predetermined formula.

21. A proximity warning device substantially as described with reference to and as illustrated in the accompanying drawings.

22. A vehicle capable of alerting a driver of a trailing vehicle that the trailing vehicle is following too closely substantially as described with reference to and as illustrated in the accompanying drawings.

The Patent Office

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Application No: GB 9603022.6 **Examiner:** Mr Conal Oram
Claims searched: 1-22 **Date of search:** 15 April 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G1G (GRE), H4D (DRPC, DLAB), G4Q (QCE)

Int Cl (Ed.6): G01S (13/93, 15/93, 17/93), G08G (1/16)

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2291244 A	(DESIGN) See page 12 line 20 - page 13 line 10 and page 16 lines 6-8.	1, 3, 5-8, 10, 12-15, 17, 19 and 20.
X	GB 2260209 A	(HARDY) See figure 5, page 2 lines 1-25 and page 5 lines 20-21.	1-4, 6-11, 13-18 and 20.
X	GB 2222710 A	(HOME) See whole document especially page 1 lines 15-20, and page 3 lines 4-7 and 24-29.	1, 7, 8, 14 and 15.
X	WO 87/02812 A1	(ATTIKIOUZEL et al) See whole document especially page 5 lines 9-10 and page 6 line 27 - page 7 line 3.	1, 3, 6-8, 10, 13-15, 17 and 20.
X	US 4833489	(DAVID) See column 7 lines 53-59, column 9 lines 45-47, column 10 lines 6-56 and column 16 lines 16-24.	1-3, 6-10, 13-17 and 20.

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.