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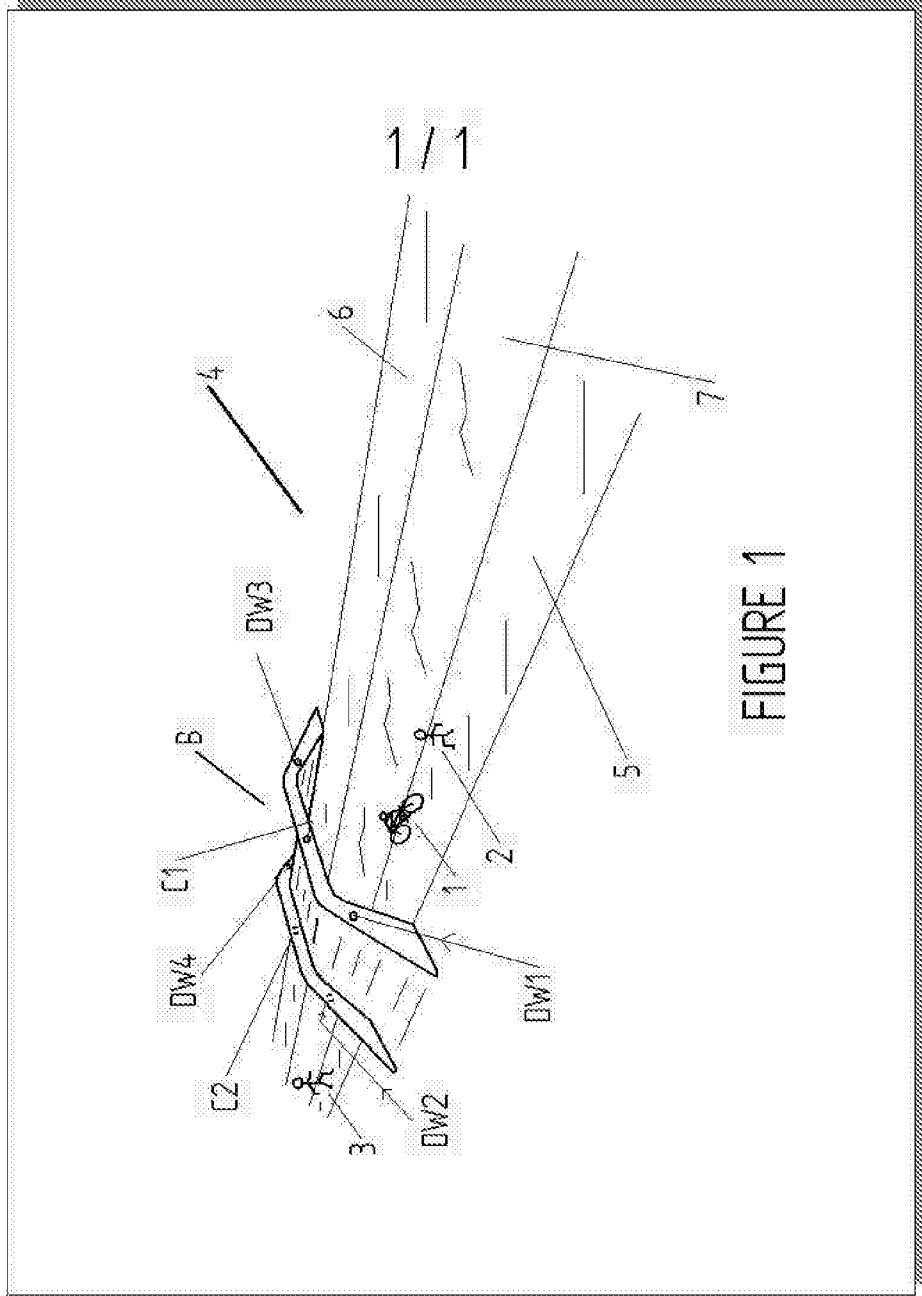
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DETECTION SYSTEM

This invention relates to methods and apparatus for warning walkers, runners, and cyclists, using the towpath of a canal, and persons located in water craft using the canal, and those using other means of transportation in other environments, that other persons, animals, and water craft are approaching, where appropriate, in those situations in which all said persons have their vision obscured by objects such as bridges, and tunnels, and other causes of restricted vision, such as bends in the canal, wherein the said persons who are not in a water craft, are walking, cycling or running, and wherein the invention also applies to persons using any other path in other locations. Such detection and warning is necessary due to the need for avoiding contact between people and animals, in order to prevent injury, and loss of life, and to protect the health of those who might otherwise get too close to someone who is carrying an infectious disease, for example a virus such as the Corona Virus, wherein all such forms of contact can lead to loss of life.

According to the present invention, a detection and warning system is located at, or near, the entrance to a bridge or tunnel so that the warning part of the apparatus of the system, for instance a source of light, can be seen by persons entering the bridge or tunnel via either pedestrian entrance, on either side of the canal, where applicable, and from water craft, entering from either entrance. The system thus provides means for warning persons who are approaching, and about to enter, the bridge or tunnel, that other persons or animals are approaching them via the other entrance to the bridge, or tunnel, and that those in a water craft are being approached by another water craft approaching the other entrance to the bridge or tunnel, so that all persons on the canal towpath can take necessary action in order to avoid coming into close contact with one another and thereby avoid becoming infected by a virus carried by other persons or animals, and avoid injury, wherein those persons in a canal water craft can thus also be prepared to take the necessary action.

Application of the invention to a long tunnel involves a more complicated system of warning which prevents a water craft from entering the tunnel if another craft is in the tunnel. This system has a warning light located at each end of the tunnel at a suitable distance from each entrance so that barges may pass one another, wherein for instance, a red warning light is on at the entrance to one end of the tunnel when a craft in the

tunnel will eventually leave at that entrance. Any craft wanting to enter from that entrance will be warned of the presence of the craft in the tunnel, and will therefore wait until it leaves, whereupon a first other craft which is about to enter the tunnel is only allowed to enter it if the red warning light is not on, wherein, in case the power to the warning light fails, a failsafe principle applied within the system, displays a signposted warning which is not powered, and advises continuation into the tunnel with extreme caution if the red light is not on.

Radio frequency communication between the detection means at each entrance to the tunnel and the warning means at the each other entrance, will provide the required response.

The invention utilises the principles of motion detection, wherein common methods for detection are based upon the detection of heat, and incorporate Passive Infrared Detectors, known as PIR detectors, and PID detectors, which detect motion by utilising pyroelectric materials which generate energy when exposed to heat. Other methods are based upon the use of ultrasonics, and yet others are based on the use of microwave radiation, wherein both such methods, utilise Doppler radiation processing techniques, based upon the Doppler Shift phenomenon, wherein, for example, those based upon Doppler Radar, utilise microwave radiation.

The detectors and warning means relevant to approaches via the entrances to each side of the bridge or tunnel communicate with one another, either via a hard-wired link, or by means of electronic radiation, for instance radio frequency radiation, so that approaches of persons to each of the entrances to a bridge or tunnel implement a warning signal at the opposite entrance to the bridge or tunnel.

In those situations in which the view of the path or canal ahead by someone is obscured by objects such as hedges and the like, or is due to a bend in the path of the canal, and therefore the canal itself, detection and warning means are located on a conveniently located post, as high above the ground as possible in order to prevent theft or damage, whilst still providing detection and warning, wherein if the height above ground level is such that a visible warning is not easily seen, the visible warning means is lower down, with adequate protection from tampering, or an audible warning,

or both, are provided, with the necessary implementation of communication between the visible and audio warning means, and the detection, means.

5 The apparatus of the said system thus provides a warning to the user in the form of a flashing light, or an audible alarm, wherein visible means are preferred because they are less objectionable in locations where other persons not requiring the use of the system live, work, or recreate. Thus, for example, many canals have houses or other buildings close to them.

10 Whilst various alternative methods of detection and warning are usable for implementing the principles of the invention, the most appropriate ones will be based on minimum cost, simplicity, durability, and protection from tampering, with an accompanying minimum of required maintenance. Powering of the apparatus is by means of i) solar panels, ii) wind energy, iii) the locally available electrical supply, or
15 iv) batteries; which are ideally of the rechargeable type.

It is pointed out that it is important to ensure that the apparatus of the invention does not present a hazard to anyone, and that any radiation emitted by it, does not cause interference with any other apparatus. Thus, for instance, pacemakers, and any
20 equipment involving electronic apparatus, must not be adversely influenced by the apparatus of the said invention to the extent that that equipment fails to work satisfactorily, or is damaged.

It is further pointed out that, in order to reduce the length of this account, unless there
25 is a need for a specific reference to a tunnel, the use of the word bridge is also taken to refer to a tunnel.

In order to describe the invention in more detail, reference will now be made to the accompanying diagram in which:

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Figure 1 shows a three-dimensional schematic diagram, representing a common scenario in which a cyclists, runners, and walkers, are approaching a bridge over a canal.

35 With reference to Figure 1, which represents a three-dimensional, schematic view, this

shows a scenario in which a cyclist, 1, and walkers or runners, 2, and 3, are approaching a bridge, B, which traverses a canal, 4, having paths, 5, and 6, and water, 7, wherein the bridge, B, is provided with detection and warning means, DW1, and DW2, DW3, and DW4, located on the visible parts of the bridge, B, on its side parts, 5 on both sides of the bridge, B, as shown, wherein centrally located detection and warning means, C1, and C2, provided for water craft, are positioned similarly, on the visible parts of the bridge at central locations at both entrances to it, for viewing by users of water craft.

10 It is pointed out that detection and warning means, C1, and C2, are mainly for the use of those operating water craft, but provided that the range of detection that they can provide is adequate, they are also usable by those on the canal towpaths, and all detection and warning means are also of use to fishermen who might need to remove fishing tackle because of approaching water craft.

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It is further pointed out that, whilst warning and detection means are locatable as shown in Figure 1, these are alternative positions for the detection and warning means, and some of these are only necessary when there is a relevant towpath in use. Moreover, since motion detection devices which utilise the Doppler principle, at Giga 20 Hertz microwave frequencies are able to detect objects which are obscured by other objects and materials, they can be protected from wear and tampering by being embedded in suitable protective materials; even in concrete, whilst also preventing damage and theft. Thus, these types of motion detector can function whilst being hidden, and communicate with their associated warning means via radio frequency 25 radiation.

The other detectors, which have already been referred to, are based upon the detection of heat and are known as Passive Infra-Red (PIR) detectors. They are generally cheaper, but not so durable, bearing in mind that the localities involved are often 30 exposed to extremes of weather.

With further reference to Figure 1, the canal, 4, has towpaths, 5, and 6, and water, 7, so that, as cyclist, 1, and runner, 2, approach one entrance to the bridge, B, the detection part of the detection and warning means, DW1, or C1, if applicable, detects their 35 approach, whilst the warning part turns on a light or a source of sound, which are seen

or heard, respectively, by the walker, 3, who is approaching the other entrance to the bridge, B. Likewise, the approach of the walker, 3, is detected by means of detection and warning DW2, or C2, and the warning means at the positions of DW1, and C1, warn the cyclist, 1, and the runner, 2, that the walker, 3, is approaching the bridge, B.

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In order to assist in detection, particularly if there is a bend in the canal, repeating, warning means, which receive signals from the detection means on the bridge, are located at strategic locations at a suitable distance from each entrance to it, beyond the bridge, on each side of the canal, and provide means for warning users of the canal that
10 others are approaching them, who are about to enter the bridge, at the entrance which is opposite to the one that they are using.

The visible warning means comprise a source of light which is located on each side of the bridge, B, which flashes, or stays on until detection ceases, wherein the light is of a
15 suitable colour, for instance, red. A more elaborate system of visible warning involves an amber light which is turned on when a person, A, for example cyclist, 1, shown in Figure 1, who is some distance away from the bridge, approaches, and is turned off and is replaced by the turning on of a red light, when the approaching person, A, is close enough to the entrance of the bridge to require the other person, B,
20 for instance walker, 3, who is approaching from the other direction to wait until person, A, has exited the bridge.

Other features of the apparatus of the system provide for measurement of the speed of approach of persons to the bridge or tunnel so that a warning indicator having a textual
25 display, which can display their speed, warns them of the need to slow down and be prepared for the presence of other users who are inside the bridge, or who are close to its entrance.

CLAIMS

1. A detection and warning system, in which i) the apparatus for detection and warning utilises the principles of motion detection based on the application of the Doppler Principle and uses microwave radiation for detection and warns persons who are approaching one another, or who are being approached by animals, and in which ii) the said system is suitable for application in those situations in which such persons have their vision of the view ahead of them obscured by causes of restricted vision, which are stationary objects such as bridges, tunnels, hedges and the like, or have their vision limited by bends in the route which they wish to follow, so that in all such cases they can take evasive action, wherein the method for detection of motion utilised by the said system is based on the transmission to, and reflection from, an object, of microwave radiation, created in apparatus which utilises Doppler Radiation processing techniques based upon the Doppler Shift phenomenon and Doppler Radar, wherein, since the apparatus of the said motion detection system utilises the Doppler principle, at Giga Hertz microwave frequencies, it is able to detect objects which are obscured by other objects and materials due to the greater penetrating effect of microwave radiation, wherein this renders the apparatus protectable from wear and tampering, by being embedded in suitable protective materials, such as concrete, if necessary, whilst also preventing damage and theft, wherein, this type of motion detector can thus function whilst being hidden, and is able to operate at high and low temperatures, and under other extremes of weather, and is thus suited to use in outside applications, whereas, in contrast, infrared motion detection systems which are based upon the detection of heat, incorporate Passive Infrared Detectors, known as PIR detectors, and PID detectors, which detect motion by utilising pyroelectric materials which generate energy when exposed to heat, and are relatively of low cost, but not so durable, and will be less suitable to application in locations which are often exposed to extremes of weather, and temperature, and are more suited to application indoors, but are operable, and functional, in certain outside locations, but wherein, because they rely on the detection of heat, they are not as effective in cold weather as is the said method based on the Doppler Shift Principle, wherein the said motion detection and warning means of the said system are assembled, fitted securely, and set in working order, by persons skilled in the

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relevant Art, and the said microwave based motion detection system is safe to use, and is constructed to be suited to location at, or near, the position of, and is located on, the said various causes of restricted vision, and is located appropriately where the said bends occur, and appropriately where other causes of limited vision occur, when any of the said causes of restricted view are being approached by the said persons and animals, so that the persons and animals can be detected by the apparatus of the system as they make their approach to the said causes of obstruction and limitation to vision, and wherein the said method of motion detection of the said system involves relaying a signal resulting from the said detection, either via a hard-wired link, or by means of electromagnetic radiation, for instance radio frequency radiation, to visible or audible, warning means seen or heard by the said persons, and which are activated by the said signal, and are suited to location, and are located in, positions where they can be seen and heard by the said persons who are approaching the said obstructions and limitations to vision, on either of the relevant sides of them, appropriately, and wherein the visible and audible warnings are active for the time during which the person or animal causing the detection is within the confines of the said bridge, or tunnel, or when that person or animal is not in the direct line of sight of another person who is approaching them, so that approaches of persons to each of the entrances to a bridge or tunnel, or approaches to either side of another obstruction or limitation to view, or approaches to either end of to a bend, implement a warning signal at the opposite entrance to the bridge, or tunnel, and on the other side of the said obstruction to view, and beyond each end of a said bend, wherein the detection and warning system is intended for use by persons who are walkers, or runners, or cyclists, whilst they are using an outside route which is not a road used by motorised vehicles, and which outside route is also intended for use by other persons whilst they are using other permitted means for transporting them, for instance a bicycle powered by means of electricity, and the like, when following the said outside route, in all situations in which any of such persons using the said outside route have to negotiate a said bridge, tunnel, or said stationary other obstruction, or limitation to their view, whilst using a said outside route, so that, for all such causes of restricted view, the visible warning part of the apparatus of the system, for instance a source of light or the audible part, for instance, a source of sound, can be seen and heard, respectively, by persons who

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are entering the bridge, or tunnel, via either entrance, or are negotiating the said obstruction, or are negotiating a bend, from either side of it, wherein the system thus provides means for detecting persons, who are approaching one another, and animals which are approaching the said persons, as they are about to enter the bridge or tunnel, or are about to negotiate the said obstruction, or said bend, and thus provides means for detecting animals which are approaching any of the said persons, so that all persons can take necessary action.

2. A detection and warning system as claimed in Claim, 1, wherein, in those situations in which, for the said persons, the view ahead that they wish to follow, is obscured due to a bend in their intended route, or by other causes of obstruction and limitation to vision, the detection and warning means are positioned on a conveniently located post, as high above the ground as possible in order to prevent theft or damage, whilst still providing detection and warning, wherein, the visible and audible warning means are positioned at a height above ground level such that they can be seen and heard, with adequate protection from tampering, for both the visible and the audible warning means, and with the provision of adequate communication between the detection means, and the visible and audio warning means, at the locations of these, and also when the warning is to be relayed from the detection means to the respective other entrance to a bridge or tunnel, or respective other side of an obstruction, or beyond a said bend.

3. A detection and warning system as claimed in Claim, 2, wherein in order to assist in detection and warning, particularly if there is a bend in a canal, repeating, warning means, which receive signals from the detection means on the bridge, are located at strategic locations at a suitable distance from each entrance to it, beyond the bridge, on each side of the canal, and provide means for warning users of the canal that other persons or animals, who are about to enter the bridge, are approaching them, at the entrance which is opposite to the one that they are using, wherein this provides a means for early warning to persons where appropriate, and necessary, wherein the said assistance in detection and warning via the provision of repeating warning means is also applied to the said other causes of restricted vision.

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4. A detection and warning system as claimed in claim, 3, which is based on the transmission to, and reflection from, an object, of microwave radiation, created in apparatus which utilises Doppler Radiation processing techniques based upon the Doppler Shift phenomenon and Doppler Radar, wherein, since the apparatus of the said motion detection system utilises the Doppler principle, at Giga Hertz microwave frequencies, it is able to detect objects which are obscured by other objects and materials due to the greater penetrating effect of microwave radiation, wherein this renders the apparatus protectable from wear and tampering by being embedded in suitable protective materials, such as concrete, if necessary, whilst also preventing damage and theft, wherein, this type of motion detector can thus function whilst being hidden, and wherein such detectors are able to operate at high and low temperatures, and other extremes of weather, and are thus suited to use in outside applications, wherein the said motion detection and warning means of the system are assembled, fitted securely, and set in working order, by persons skilled in the relevant Art, and the said microwave based motion detection system is safe to use, wherein, the said method for motion detection is superior to those infrared detectors which are based upon the detection of heat, are not so durable, and will be less suitable to application in locations which are often exposed to extremes of weather, and temperature, and are more suited to application indoors, because they rely on the detection of heat, and are not as effective in cold weather, wherein the said motion detection and warning means of the said system of the invention are assembled, fitted securely, and set in working order, by persons skilled in the relevant Art.
5. A detection and warning system as claimed in Claim, 4, in which the apparatus for detection and warning is utilised for warning persons using the towpath of a canal who are approaching one another or who are being approached by animals, in those situations in which such persons have their vision obscured by objects such as bridges, as described with reference to Figure 1 of the Drawings, and by objects such as tunnels, and by other causes of restricted vision, such as hedges and the like, by bends in the canal, bends in the path used by such persons, and by other causes of limited vision, wherein the said persons are walkers, runners, or cyclists, and wherein the warning means are visible to the said persons, or are audible to the said persons, and wherein such detection and warning is necessary due to the

need for avoiding direct contact between persons and animals, and for allowing persons to avoid being closer than a specified distance from other persons and animals.

- 5 6. A detection and warning system as claimed in Claim, 5, which is located at, or near, the entrances to a bridge or tunnel on a waterway such as a canal, so that the warning part of the apparatus of the system, for instance a source of light, can be seen, or a source of sound can be heard, by persons entering the bridge or tunnel via either entrance, whilst operating water craft, wherein the system provides
- 10 means for detecting such water craft when they are approaching one another, so that those operating the water craft can take necessary action in order to avoid coming into contact with one another and thus also be prepared to take necessary action in order to avoid a collision, and to avoid coming closer than a specified distance from one another, wherein the visible and audible warnings are active for
- 15 the time during which the water craft causing the detection is within the confines of the bridge, or tunnel.
7. A detection and warning system as claimed in Claim, 6, wherein application of the system to a long tunnel involves a more complicated system of warning which
- 20 aims to prevent a water craft from entering the tunnel if another craft is in the tunnel, wherein this system has a visible warning, for instance a warning light which is located at each end of the tunnel on the outer surface of the tunnel so as to be clearly visible to operators of water craft, or is located at a suitable distance from each entrance to the tunnel, so as to be clearly visible, and so that water craft
- 25 which have to eventually pass one another when away from an entrance, may pass one another safely when they are at a convenient distance from the entrance, wherein for instance, a red warning light is on at the entrance to one end of the tunnel when a craft which is in the tunnel will eventually leave at that entrance, wherein any craft wanting to enter at that entrance will be warned of the presence
- 30 of the said craft that is in the tunnel, and will therefore wait until it leaves, whereupon a first other craft which is waiting, and about to enter the tunnel at that said entrance is only allowed to enter it if the red warning light is not on, and itself causes a warning to be given at the entrance from which it is intended to leave at the other end of the tunnel, wherein, in case the power to the visible warning, for

example a source of light, fails, a failsafe principle applied within the system, displays a signposted warning which is not powered, and which advises continuation into the tunnel with extreme caution if the red light is not on, wherein a detection signal is sent to the associated warning means of the apparatus of the system, via electromagnetic radiation, for instance, radio frequency radiation, or via hard-wiring; radio frequency communication between the detection means at each entrance to the tunnel and the warning means at the each other entrance, thereby providing the required warning.

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- 10 8. A detection and warning system as claimed in claim, 1, in which the said visible warning is in the form of a source of light, or a textual display, and the audible warning is in the form of an audible alarm, but wherein visible means are preferred because they are less objectionable in locations where other persons not requiring the use of the system live, work, or recreate, wherein for example, many
- 15 canals have houses or other buildings close to them.
9. A detection and warning system as claimed in Claim, 1, which is protectable from tampering, with an accompanying minimum of required maintenance, and wherein electrical powering of the apparatus of the invention is by means of either
- 20 i) solar panels, ii) wind energy, iii) the locally available electrical supply, or iv) batteries; which are ideally of the rechargeable type.
10. A detection and warning system as claimed in Claim, 8, or Claim, 9, wherein, for instance, the detection and warning means, C1, and C2, located on a canal bridge,
- 25 B, and shown in Figure 1 of the Description, are also locatable at the entrances to a tunnel, and are mainly for the use of those operating water craft, but wherein, provided that the range of detection that the detecting part of C1, and C2, can provide is adequate, they are also usable by persons on the canal towpath, because they will detect persons and animals which are on the towpath, as well as water
- 30 craft, wherein the detection and warning means are also of use to fishermen who might need to remove fishing tackle from the water because of approaching water craft, or remove fishing tackle from the towpath because of walkers, runners, cyclists, and animals, using the canal towpath, wherein, equally, whilst detection and warning means, DW1, DW2, DW3, and DW4, shown in Figure 1, are mainly

for use by those on the canal towpath, if they have adequate range, they can be utilised by operators of water craft, wherein, however, the range of detection must not be so wide as to cause false tripping on one towpath of a canal, which is the result of persons or animals using the towpath on the other side of the canal.

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11. A detection and warning system as claimed in Claim, 1, in which the visible warning means is, for instance, a textual display, or a source of light which flashes, or is a light which is on for a duration, wherein each type of visual warning is located on each side of the bridge, B, shown in Figure 1, and becomes
10 active until detection ceases or where/when necessary, remains active for sufficient time to ensure that the warning continues to be given whilst the person or animal that has given rise to detection is within the confines of the bridge, or tunnel, wherein the said light is of a suitable colour, for instance, red, and wherein a more elaborate system of visible warning involves an amber light which is
15 turned on when a person, A, for example cyclist, 1, shown in Figure 1, who is some distance away from the bridge, approaches it, and is turned off, and is replaced by the turning on of a red light, when the approaching person, A, is close enough to the entrance of the bridge to require the other person, B, for instance walker, 3, who is approaching from the other direction, at the other entrance to the
20 bridge, B, to wait until person, A, has exited the bridge, wherein, the said alternative warning means are turned on at the opposite entrance to the bridge to the one which is being approached by the person being detected.

12. A detection and warning system as claimed in Claim, 1, in which other features of
25 the apparatus of the system provide for measurement of the speed of approach of persons and animals to bridges, tunnels, or other causes of restricted or limited vision, and in which the visual warning provides a display of this speed via an indicator having a textual display which, by displaying the speed, warns persons of the need to slow down and to be prepared for the approach of other persons or
30 animals which are within the confines of the bridge, or tunnel, or which are close to its other entrance or are on the other side of the other said causes of restricted or limited vision, wherein, these other features also involve, if required, the use of textual displays which show the speeds of approach of a person to their entrance to a bridge or tunnel, or other said obstruction to view, and also the speed of the

person or animal approaching the other entrance to the bridge or tunnel, or other obstruction to view, so that each person thus sees their speed and that of the approaching person or animal.

5 13. A detection and warning system as claimed in Claim, 1, in which the apparatus of the invention does not present a hazard to anyone, and is such that any radiation emitted by it does not cause interference with any other apparatus, wherein, for instance, pacemakers, and any equipment involving electronic apparatus, must not be adversely influenced by the apparatus of the said invention to the extent that
10 that equipment fails to work satisfactorily, or is damaged.

14. A detection and warning system as claimed in Claim, 1, wherein such detection and warning is necessary due to the need for i) avoiding contact between persons and for avoiding contact of persons with animals, ii) the need for avoiding
15 collision, and iii) for allowing persons to take evasive action quickly enough in order to avoid being closer than a specified distance from one another and from animals, and thereby to avoid contracting an infectious disease such as a virus, and in particular, the Corona Virus, wherein, in comparison with known methods which are associated with detecting and warning retrospectively of the contact of
20 persons with one another, or how close persons have come to one another, the present system, instead, warns persons in sufficient time, that is, dynamically, for them to take evasive action, and so, rather than being able to act accordingly, for example, undergo “lockdown”, under current rules, they can avoid such closeness, and hence avoid contracting the said virus in the first place.