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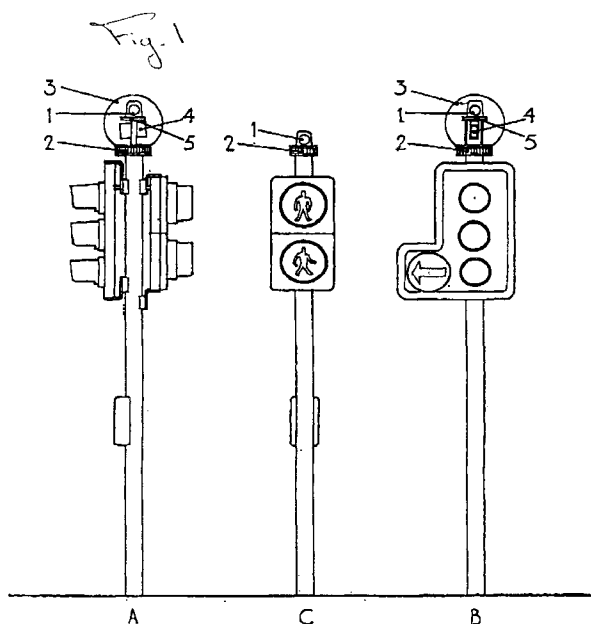
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(54) Improvements in or relating to traffic control

(57) Existing traffic-light installations are fitted with additional emergency lighting 1 and audio alarm system 2 mounted on top of the traffic-light, or elsewhere, and may be enclosed in a clear perspex or acrylic dome or sphere 3 which may also incorporate a directionally variable Passive Infra Red (PIR) sensor 4 and an intermediate light support platform 5. The emergency light and audio alarm system are activated simultaneously in conjunction with the traffic-lights, by emergency or other authorised vehicles in transit, by means of an emergency radio or electronic signal transmitted to remote sensors or transponders, or by infra red wave or sound-activated

or emergency light-activated sensors which in turn trigger the emergency traffic-light and advance warning systems in advance of the approaching vehicle. The interactive feedback from the traffic-lights to the onboard display in the vehicle via the two-way signal system confirms receipt and activation of the over-ride command, and may also provide additional information to the vehicle and to its central control computer. Once the junction has been passed safely the emergency over-ride systems are cancelled out by similar means. Installations may be triggered or cancelled out in sequence where appropriate.

**EP 0 797 179 A1**

Description

This invention relates to traffic control, and in particular to an apparatus for and method of mobile control of traffic lights by emergency services and other authorised vehicles in transit, which may incorporate a visual and audible advance warning system to alert vehicular traffic and pedestrians of the impending approach of the emergency vehicle to the locus controlled by the traffic lights.

Current traffic lighting control systems have been largely standardised throughout Europe and the rest of the world, on a pattern of RED-AMBER-GREEN-AMBER-RED denoting STOP-GET READY-GO-CAUTION-STOP. Apart from this generality of operating sequences the format of traffic lights varies widely from country to country, and in some cases the sequential operations also vary from the norm.

Problems arise when emergency services and other priority traffic require to pass through junctions controlled by traffic-lights, particularly when such transit is in conflict with the priorities indicated by the traffic-lights. The dangers inherent in such situations require the slowing down and negotiating of the junction with extreme care by the emergency service vehicle, often with a loss of critical time.

In addition to this, accidents have occurred in the past, and are likely to continue occurring in the future, when motorists "jump" the traffic signals on amber or red, and this is of particular importance when emergency vehicles may be passing through the junction on a green light in the crossing direction, and at speeds in excess of the legal limits imposed. A further complication may arise where two or more emergency vehicles approach the same junction from different directions en route to an emergency, or emergencies.

A system of priority access now exists within Strathclyde Regional Fire Brigade wherein all sets of traffic-lights on a pre-determined route, from the Fire Station to the locus of a fire alarm, are mastered by a computer controlled signal to change all lights at the junction to red, with the exception of the direction of travel of the fire tender, which is set to green. This allows traffic ahead of the fire tender to clear the junction, while effectively paralysing all other directions of travel. This system is designated GREEN WAVE.

A further, experimental system of control exists within Falkirk, where fifty buses have been fitted with a means of turning traffic-lights to green, by remote control.

However, the danger of accidents occurring still persists, particularly where traffic is kept waiting at a junction on red lights, for no apparent reason, and motorists proceed to drive through the junction on the assumption that the traffic-lights have broken down. If this action coincides with the high speed approach of a Fire Tender, anticipating a clear run through the GREEN WAVE junction, then severe difficulties could arise.

In addition to this a serious conflict could arise if, for example, a Police Car and a Fire Tender, or two Fire Tenders, were approaching the same GREEN WAVE junction from different directions, either heading for the same emergency, such as a terrorist bomb explosion, or for different emergencies. The uncertainties posed by the variety of conflicting situations which could arise will inevitably require all emergency vehicles to approach light-controlled junctions with extreme caution, particularly bearing in mind the essential requirement of reaching their destination intact. The time lost as a result of this requirement may be critical in terms of life and death, and improvements in emergency response times are currently measured in seconds. Research has shown that fire doubles in intensity every minute.

A hierarchy of priority is also established by GREEN WAVE, as it is operated by the Fire Service, and Fire Tenders will automatically assume precedence over other emergency services.

Difficulties can also arise when a motorcade carrying Royalty, Heads of State or other VIP's is in transit and requires to pass through a series of junctions controlled by traffic-lights. Current practice in such circumstances is to have each junction controlled by Police officers to ensure that the safety of the occupants is not in any way compromised by having to slow down, with a consequent increase in vulnerability. This is expensive in terms of man-power, particularly where Police officers may be on station for an extended period of time, if the motorcade, or the VIP party, is delayed for any reason.

Consider, therefore, a universal priority system of mobile control, available to all emergency services, and including other authorised vehicles such as VIP and Royalty motorcades. Such a system would require to be capable of being activated and de-activated in relatively close proximity to the junctions controlled, to minimise disruption and inconvenience to other road users. The system should also incorporate a means of informing other road users, and pedestrians, that the normal functioning of the traffic lights has been over-ridden by remote control and that an emergency vehicle, or other authorised vehicle is approaching the junction with uninterrupted priority of access.

A system according to the present invention seeks to meet this requirement, and is designated BLUE FLASH, for reasons which are self-explanatory. Embodiments of the invention provide a complete system of remote control of traffic-lights for on-the-spot use by emergency and other authorised vehicles, with a minimum of disruption to other traffic and road users, and with an additional visual and/or audible advance warning system to alert everyone within the vicinity of the impending arrival of the emergency vehicle.

According to a first aspect of the present invention there is provided an emergency warning and control system which provides over-riding remote control of traffic-lights at controlled junctions, pedestrian crossings and other locations, by emergency and other authorised

vehicles in transit, or by centralised computer control, by means of inductive loop transponders, or by radio wave or infra red wave transmission, or by siren or sound activated, or emergency light activated sensors, or other means, to provide a priority passage facility to the emergency or other vehicle, and which incorporates a strobe light or rotating flashing light or other emergency lighting system and an audible alarm system, both mounted on top of the traffic-lights, or elsewhere, and which operate simultaneously and in conjunction with the controlled traffic-lights.

According to a second aspect of the present invention there is provided a rotating or flashing emergency light on each, or selected, traffic-light poles or the like at intersections, or in other locations as may be appropriate, together with an audio alarm system linked to the emergency light, and both being operated by remote control by means of a transponder, radio wave, infra red wave, sound activated or emergency light activated mechanism, or other device, which is in turn activated by a radio or other type of signal issued by the approaching vehicle. In addition to this the system advantageously incorporates a linked, simultaneous remote control of the traffic lights to provide a GREEN WAVE or other similar facility, such as the use of the traffic lights as an indicator of status by changing to flashing red, flashing red and amber, or other combination, which provides priority passage for the emergency or authorised vehicle through the traffic light controlled junction.

According to a third aspect of the present invention there is provided an emergency warning/control system for one or more traffic lights/pedestrian crossings, characterised in that the system comprises means provided on a vehicle for controlling the traffic lights/pedestrian crossing(s), means provided on/or near the traffic lights/pedestrian crossing(s) for warning road users of approach of the vehicle, and means provided on the vehicle for controlling the warning means.

According to a fourth aspect of the present invention there is provided a method of providing an emergency warning/control of traffic lights/pedestrian crossing(s), characterised in that the method comprises the steps of:

- providing on a vehicle means for controlling one or more traffic lights/pedestrian crossing(s);
- providing on or near the traffic lights/pedestrian crossings means for warning road users of approach of the vehicle;
- providing on the vehicle means for controlling the warning means

A specific embodiment of the invention will now be described by way of example, with reference to the accompanying drawing which shows:

- Fig 1 Traffic light poles A, B and C according to an embodiment of the present invention; and
 Fig 2 a partial street plan of Glasgow city centre

showing possible positions for transponders for us in the present invention.

Traffic-light poles at A and B supporting the emergency light fitting 1, with the audio alarm system speaker 2 fitted below. The light fitting is enclosed in a clear perspex or acrylic dome or sphere 3, which provides space for a standard Passive Infra Red (PIR) or other form of directionally variable traffic sensor 4, located below the intermediate light support platform 5.

A third traffic pole C incorporates an alternative, simpler installation comprising the emergency light fitting 1 supported on the audio alarm system speaker 2.

The emergency light 1 is of the type used in each country, and the colour and intermittent flashing system may vary to accord with the standard practice within each country. For example, in the UK the light 1 may be blue. The audio alarm system may also vary in accordance with the accepted type in each country, and may comprise wail, yelp, alternating two tone pattern, rise and fall siren pattern or other emergency alarm system as may be appropriate, to warn motorists, other road users and visually impaired pedestrians of the impending approach of the emergency vehicle.

The BLUE FLASH installations are wired up in a single circuit, or in multiple circuits, so that all emergency lights at each junction operate simultaneously on command, together with the audio alarm system and the GREEN WAVE or similar traffic light control command. The lighting circuit, or circuits, is controlled by a number of remote sensors, or transponders 6, positioned at a predetermined distance from the junction on each of the approach roads. An alternative method of activating the system may be by radio wave, by infra red wave, or by sound activated or emergency light activated sensors. Control of the traffic lights and BLUE FLASH installations may also be by central computer or by means of a signal emitted by a Global Positioning system (GPS) via a satellite. These trigger the emergency installations in advance of the approaching vehicle, and the installations may be linked in sequence where a number of traffic-lights occur within a relatively short distance along the proposed route.

The emergency signal emitted by the emergency vehicle may be incorporated into the emergency lighting or emergency alarm system of the vehicle so that it operates automatically when these systems are in operation, to provide an automatic and interactive response with the traffic-lights controlled. The normal non-emergency signature of the vehicle, received and acknowledged by the transponder or other sensor, will change automatically to an emergency signature as soon as the siren and flashing lights are activated. The emergency signal issued to the traffic-lights via the transponder, or other system utilised, will activate the BLUE FLASH systems ahead of the vehicle, and a return signal via the read/write transponder or other system will confirm receipt of command and activation of the system, together

with other intelligent feedback, to an on-board receiver unit display within the vehicle, and also to the command Headquarters and/or central control computer. Thus the vehicle driver or crew may receive a signal in the vehicle confirming activation of the priority system, and which may also include data on vehicle speed, distance to lights, start time and duration of green light priority signal and other information.

The two way communication system established may also give additional feedback on forward road and/or traffic conditions, location, speed and direction of other emergency vehicles and other information. The information thus received will enable the driver to reduce or increase speed in order to gain maximum benefit from the BLUE FLASH facility provided, again gaining valuable seconds in response time.

Once the junction has been passed the emergency installations may be cancelled by a second sensor or transponder located at a predetermined distance from the junction on the departure side. A number of junctions may be cancelled in sequence, and a single transponder may be adapted to perform both on and off functions controlling the emergency installations. This facility would also apply to the other means of controlling the system noted above. The information feedback will also inform the control computer, and/or Headquarters, and other emergency vehicles of the completed safe passage through the controlled intersection thus enabling them to initiate their own BLUE FLASH command in following mode or in approach from different directions.

As a result of this system the junctions en route would effectively become paralysed in advance of the approaching vehicle, by the various traffic-lights displaying BLUE FLASH. Pedestrian and vehicular road users would quickly become familiar with the knowledge that when BLUE FLASH was in operation, high speed transit of the junction by emergency vehicles would be imminent. By exhibiting a clear and unequivocal message to all within the vicinity, prior to arrival, the emergency vehicles would then be freer to pass through the junction without any appreciable reduction in speed, thus saving what may constitute life-saving time.

In order to protect against accidents occurring when two or more emergency vehicles are approaching the junction from different directions, the first priority signal would trigger combined BLUE FLASH and GREEN WAVE, or combined green light, on only the approach side of the junction, with a red light displayed on all other approach directions. The red lights displayed may be programmed for flashing mode to indicate that priority access has already been established in another direction. Thus the second, and any other, approaching emergency vehicle would be able to ascertain that although BLUE FLASH was in operation it displayed a red light against it, and priority of access must therefore be allocated to another vehicle. The onboard display would also confirm this information, together with additional information on location, speed, direction and timing of the

priority vehicle in advance of the second vehicle's arrival at the controlled junction.

BLUE FLASH could also be used outside the exits from emergency vehicle locations, such as Hospitals, Fire Stations and Police Stations, thus paralysing the adjacent roadway to permit immediate and unimpaired exit of the emergency vehicles.

BLUE FLASH therefore provides an autonomous in-vehicle control facility to enable authorised vehicles to guarantee unimpeded passage through all traffic light controlled junctions in their path, including traffic light controlled pedestrian crossings, and without the need for a costly Police presence or other form of traffic control. It would also reduce dramatically the time required to pass through the junction, with a consequent reduction in response time, with life saving benefits, and would also be much more user-friendly to traffic in general, as the inconvenience of paralysed junctions would be reduced to an absolute minimum.

The installation and implementation of BLUE FLASH would result in a reduction in the number of accidents arising from emergency vehicle transit of traffic-light controlled junctions, and would also save critical response time in emergency situations. In addition to this the flashing emergency lights combined with the GREEN WAVE or synchronised green light facility on the approach side only would also inform road users generally of the pending approach, and direction, of the emergency vehicle. As all traffic movement at the junction would then be paralysed, with the exception of the GREEN WAVE or green light direction, this would permit the emergency vehicle to approach the junction without slowing down, and vehicles proceeding through the junction in the GREEN WAVE or green light direction ahead of the emergency vehicle would be informed by the BLUE FLASH system and the green light facility incorporated, that an emergency vehicle was following on behind, and would therefore know to pull over to the road side on clearing the junction to leave a clear passage for the emergency vehicle.

The embodiments of the invention hereinbefore described are given by way of example only and are not meant to limit the scope of the invention in any way.

Claims

1. An emergency warning and control system which provides over-riding remote control of traffic-lights at controlled junctions, pedestrian crossings and other locations, by emergency and other authorised vehicles in transit, or by centralised computer control, by means of inductive loop transponders, or by radio wave or infra red wave transmission, or by siren or sound activated, or emergency light activated sensors, or other means, to provide a priority passage facility to the emergency or other vehicle, and which incorporates a strobe light or rotating flashing

light or other emergency lighting system and an audible alarm system, both mounted on top of the traffic-lights, or elsewhere, and which operate simultaneously and in conjunction with the controlled traffic-lights.

2. An emergency warning and control system as claimed in Claim 1, which replicates the standard emergency lighting and audible alarm systems used by Police, Fire, Ambulance and other emergency services within the country in which it is installed. 10

3. An emergency warning and control system as claimed in Claims 1 and 2 which can be activated and deactivated by emergency and other authorised vehicles in transit, or by centralised computer control or other means. 15

4. An emergency warning and control system as claimed in Claims 1, 2 and 3 and which provides interactive feedback and other information to the emergency vehicle, and to centralised computer control, confirming receipt and activation of the over-ride command. 20
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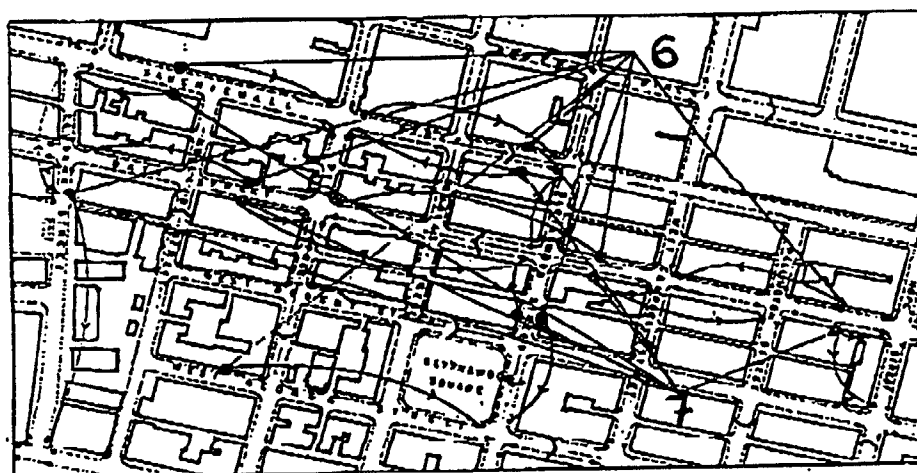
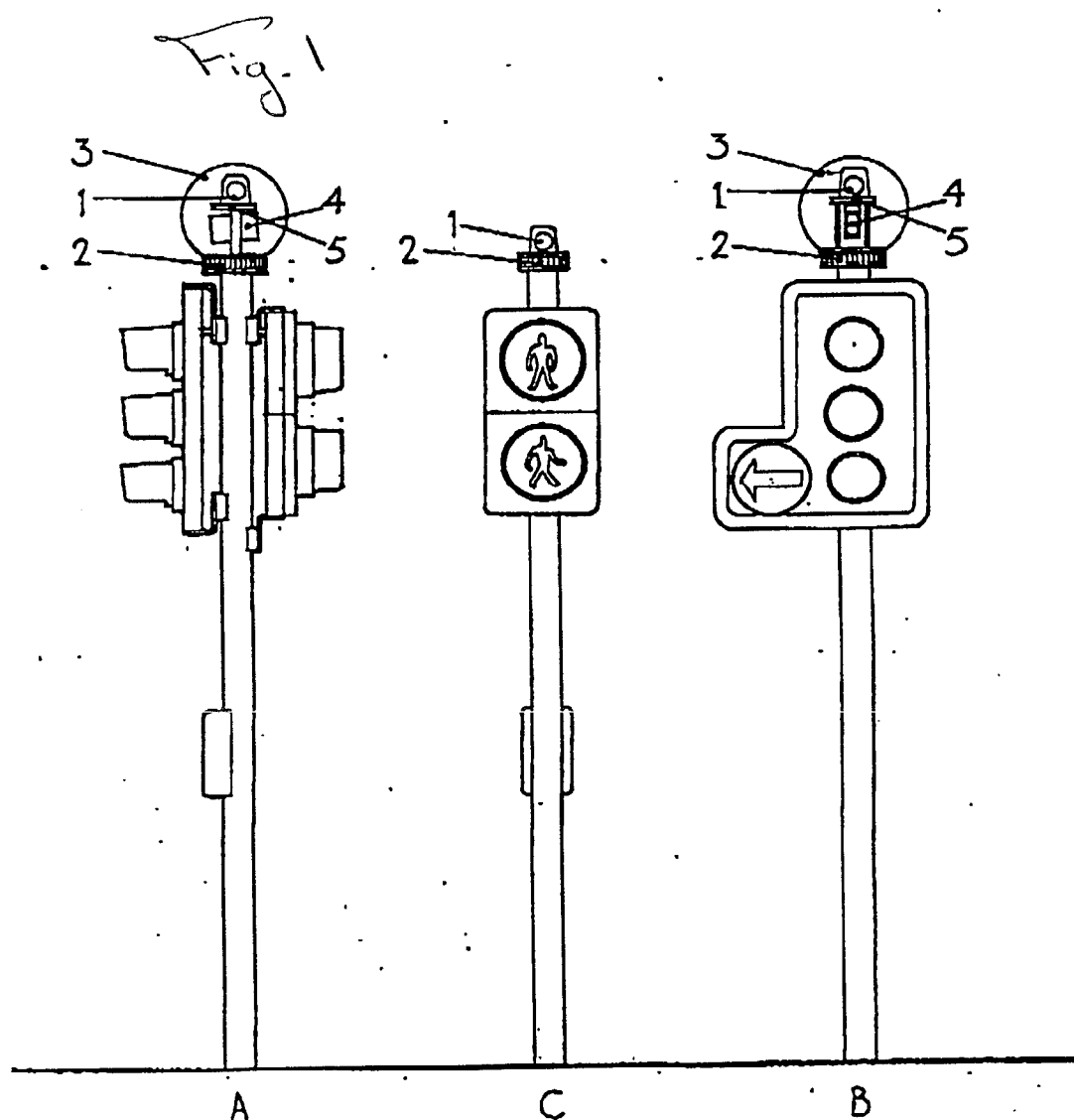
5. An emergency warning and control system as claimed in any preceding claim, wherein the system incorporates a linked, simultaneous remote control of the traffic lights to provide a GREEN WAVE or other similar facility, such as the use of the traffic lights as an indicator of status by changing to flashing red, flashing red and amber, or other combination, which provides priority passage for the emergency or authorised vehicle through the traffic light controlled junction. 30
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6. A rotating or flashing emergency light on each, or selected, traffic-light poles or the like at intersections, or in other locations as may be appropriate, together with an audio alarm system linked to the emergency light, and both being operated by remote control by means of a transponder, radio wave, infra red wave, sound activated or emergency light activated mechanism, or other device, which is in turn activated by a radio or other type of signal issued by the approaching vehicle. 40
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7. An emergency warning/control system for one or more traffic lights/pedestrian crossing(s), **characterised in that** the system comprises means provided on a vehicle for controlling the traffic lights/pedestrian crossing(s), means provided on/or near the traffic lights/pedestrian crossing(s) for warning road users of approach of the vehicle, and means provided on the vehicle for controlling the warning means. 50
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8. A method of providing an emergency warning/control of traffic lights/pedestrian crossing(s), **characterised in that** the method comprises the steps of:

providing on a vehicle means for controlling one or more traffic lights /pedestrian crossing(s);
 providing on or near the traffic lights/pedestrian crossing(s) means for warning road users of approach of the vehicle;
 providing on the vehicle means for controlling the warning means.





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EUROPEAN SEARCH REPORT

Application Number
EP 97 30 1940

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X Y	US 3 638 179 A (COLL ET AL.) * column 3, line 22 - column 5, line 35; figure 1 *	1-3,6-8 3-5	G08G1/087
Y	US 4 573 049 A (OBECK) * claims *	3-5	
X	NL 9 401 014 A (APPELMANS ET AL.) * page 3, line 21 - line 30; claims *	1-3,6-8	
P,X	DE 195 18 916 A (MEINERS ET AL.) * the whole document *	1-3,6-8	
X	US 3 257 641 A (CAMPANA ET AL.) * column 2, line 5 - column 3, line 27 * * column 3, line 54 - column 4, line 11; claims; figures 1,2 *	1-3,6-8	
X	US 2 903 674 A (SCHWAB) * column 2, line 38 - line 59; claims; figure 1 *	1-3,6-8	
A	US 4 736 186 A (JONES) * column 3, line 50 - column 4, line 9; figure 3 * * column 5, line 27 - line 48; figures 1,2 * * column 6, line 28 - line 43; figure 4 *	1-3,6-8	G08G
A	US 4 017 825 A (PICHEY) * the whole document *	1-3,6-8	
A	CH 640 653 A (SCHMIDT) * the whole document *	1-3,6-8	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 3 July 1997	Examiner Reekmans, M
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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