

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
23 February 2012 (23.02.2012)

(10) International Publication Number
WO 2012/023919 A1

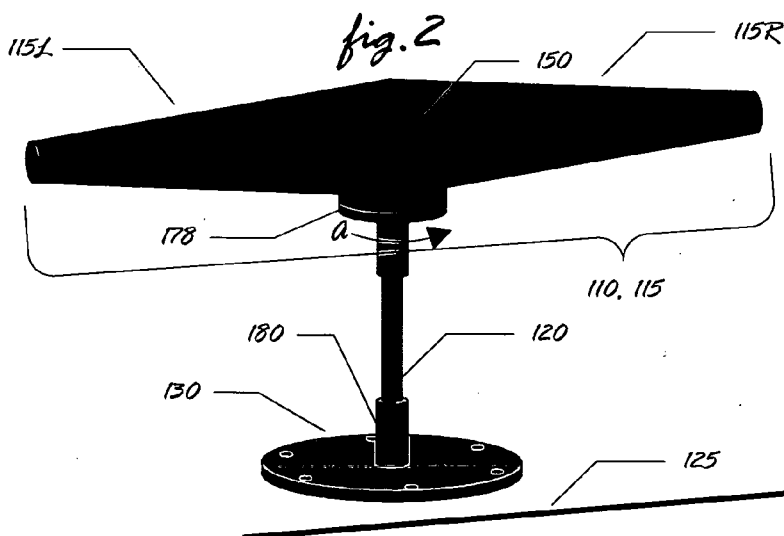
- (51) **International Patent Classification:**
G08G 5/00 (2006.01)
- (21) **International Application Number:**
PCT/US2010/002280
- (22) **International Filing Date:**
19 August 2010 (19.08.2010)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
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- (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO,

DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— with international search report (Art. 21(3))

(54) **Title:** IMPROVED BOUNDARY/EDGE MARKER AND RELATED SYSTEM



(57) **Abstract:** A boundary/edge recognition system for on ground vehicular traffic, especially airport runways and taxiways, is disclosed. The system uses multiple markers each mounted from a traditional base with a rigid structural support onto which is mounted an illuminated region with elongated, three-dimensional indicia extending outwardly therefrom. These indicia, which are self-lighting, reflective, or both, will serve as visual extensions of new or pre-existing runway/taxiway markers when oriented substantially parallel or tangential to respective runway or taxiway boundaries/edges.

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Title: Improved boundary/edge marker and related system

[0001] Technical Field – The invention is intended to improve safety for ground vehicle traffic about industrial plants and warehouses, and for outdoor venues like airport runways and taxiways. This invention especially improves the situational awareness and orientation of pilots while navigating about the grounds of an airport before takeoffs and after landings.

[0002] Background Art - Many of today's current airport runways employ a lighting system that uses runway and taxiway edge lights like those shown in accompanying FIGURE 1 – Prior Art. Such lights, or traditional omni directional luminaire 10, are commonly affixed to a vertical spar 20 which, in turn, connects to a round base plate 30. That base plate 30 typically attaches to the airport runway surface with 4 to 6 bolts (not shown) on a 10.25 inch bolt circle. From the center of base plate 30, vertical spar 20 extends upward and houses electrical wires (not shown) for supplying power to the luminaire/light source 50 sitting atop vertical spar 20. Below base plate 30, there is usually a transformer (not shown) at least partially encased in the ground and connected to wires for completing the electrical circuit for each luminaire.

[0003] In the airport lighting industry, the preceding model luminaire is known as an L-867 or “base” when it has no light atop, an L-861T for the elevated *taxiway* light model and an L-861E for the elevated *runway* light model. A light diffuser can be attached to the illumination source with one or more clamps or other quick disconnect means. That light diffuser protects the illumination source from external elements while also focusing the light emanating from same. The diffuser may be colored to help pilots better distinguish a runway light from its taxiway or obstruction light equivalents. A main advantage of the present invention is that it can be retrofitted to fit partially over and about an existing diffuser unit, fit fully over same, or fully replace the lens/single bulb of a known airport diffuser unit with the radially armed indicia described below.

[0004] Other known prior art devices in this field include the following (arranged in chronological order): Hansler et al. U.S. Pat No. 7,083,315, with their elevated runway and taxiway edge lighting system that employs light emitting diodes. Rhodes U.S. Pat No. 6,354,714 more broadly covers LED lighting systems for embedding to improve the visibility of airport runways, walkways and roadways. These same embedded LED's can also be used for floor marking. Rizkin et al. U.S. Pat No. 6,155,703 shows a surface-mounted light assembly for illuminating the outer boundaries of a ship deck or heliport. Using a prism with three flat sides, Barrow U.S. Pat No. 5,669,691 shows an in-pavement light fixture for airport runways and taxiways. A system with a series of reflective mirrors is used by the runway embedded, light emitter of Ahlen U.S. Pat No. 5,438,495. The flush runway light system of Pannier U.S. Pat No. 4,924,364 employed a removable optical unit.

[0005] Puttemanns et al. U.S. Pat No. 4,521,836 showed an elevated runway, taxiway or threshold edge light beneath a sealed glass dome. That same year, Tauber et al. patented their own airport runway, taxiway or edge light in U.S. Pat No. 4,499,527. Finally, the runway lighting system of Daley U.S. Pat No. 3,567,917 is known for employing flexible, light-conveying conduits. Despite the foregoing, improvements to this specialized field of transportation illumination are still an utmost goal as spelled out in Transportation Safety Improvements, Aviation Issue Areas, Most Wanted. See, www.nts.gov/recs/mostwanted/aviation_issues.htm#most.

Summary of Invention

Technical Problem

[0006] Situational awareness of pilots about an airport has been identified as a main contributor to runway incursions around the world. Experts have prioritized runway incursions as a top area of weakness in aviation safety. Improving the ability of pilots to quickly recognize safe runway exit locations at runway/taxiway intersections, and to better recognize the runway/taxiway intersections they are approaching will reduce the number of incidents, accidents, incursions, and excursions that occur each year. Due to the existing arrangement of runway/taxiway lights, visual orientation is especially difficult at night and during periods of reduced visibility due to precipitation and fog. Unfortunately, snow accumulations obscure visually painted pavement indicators.

[0007] Since the early days of aviation, devices have been developed for assisting pilots in navigating and recognizing their environment. Until this invention, such devices have consisted of single points of light arranged about an airport, some with lenses for light focusing for greater visibility to an approaching aircraft. In basic terms, these existing visual cues exist as nodes of light. Light nodes can become confusing at night, however, or during reduced visibility periods or when approaching the light from an angle out of alignment with the runway or taxiway they are illuminating. At larger airports, these lights may appear as a “sea” of random lights which may not provide adequate visual cues for pilots to easily navigate thereabout.

[0008] Recent systems have been designed for reducing lighting costs using technologies that consume less energy. Systems have been engineered to allow the recessing of lights to be flush with the runways and taxiways thereby reducing the risk of damage to same. Systems have also been installed to act as conventional stop lights, i.e., electronically controlled, visual signal indicators for serving as a “back up” to errant air traffic controller instructions and/or pilots and ground personnel who may accidentally cross a runway while another aircraft is taking off or landing. All of these systems improve travel safety while deploying the conventional technology of single light nodes, sometimes in varying colors, or with continuous illumination, pulsating and/or preset flash sequences.

[0009] Single nodes of light offer a good foundation for situational awareness. But such devices are not completely adequate. Recent research has taken place with regard to video displays, i.e. the visual cues used by the human eye, and the way our eyes behave to transmit sight information to the brain. From that research, it has been shown that short sequences of discontinuous lines allow the brain to more efficiently interpolate line sequences and create a more complete picture. Such line segment interpolating allows the brain to identify patterns by mapping out line segments in several directions. Similar technologies have been used for reducing the amount of information being displayed on a video monitor while still enhancing the picture that viewer perceives. However, the number, size and length of these line segments, created by pixels, vary greatly from the segments of light employed by the present invention.

Solution to Problem

[0010] The present invention overcomes the limitations of single node prior art devices described above. A principle object of this invention, in accordance with one embodiment, consists of a system of rod-like light patterns, each rod replacing, supplementing and/or enhancing the single node light atop a traditional airport light base. Utilizing a plurality of radial arms (either self-lighting, reflective or both), this invention creates illuminated line segments collinear with the airport runway or taxiway boundaries/edges they represent.

[0011] Retrofitting the known lighting systems of L-867, L-861T and/or L-861E (FIGURE 1-Prior Art) allows lighted rods to better orient horizontally, extending in the same direction as the airport pavement edge. The length and spacing of each rod can be adjusted to maximize the ability of the human eye to interpolate illuminated line segments from a distance thereby better identifying the pattern and/or delineation of airport pavement edges. The color of each rod may be specially chosen based on an accepted code representing each boundary. For example, blue rod cones may be used along taxiway pavement edges and white along segments of runway pavement edges. It is also possible to use multiple cone colors on the same lighting unit for greater directional guidance.

[0012] The rods employed by this invention may be suspended in a counterbalanced manner, extending as either: plural radial arms (per FIGURE 2); multiple rods extending in different directions for identifying a runway/taxiway intersection (per FIGURE 3); or spanning between two or more posts (per FIGURE 4). In some cases, the rod mounted about, above or below a traditional base model allows omni-directional viewing of the traditional luminaire, while providing enhanced edge line guidance over the same base model without the invention added thereto (per FIGURE 5).

[0013] When counterbalanced above a single mount, a pivot point allows the lighted rod(s) of this invention to be rotated for maintenance access. The intensity from said illumination sources can be made adjustable using existing, conventional methods.

Advantageous Effects of Invention

[0014] Each lighted rod installed according to this invention would appear to pilots and other airport personnel as a line segment, hereinafter “indicium”. The combination of indicia in an *array* of airport runway/taxiway lights creates a more accurate representation (or better simulation) of all lighted pavement edges per accompanying FIGURE 8b. When used with existing airport pavement lights, signs, and other visual cues, pilot orientation is enhanced and overall travel safety improved.

Brief Description of Drawings

[0015] Further features, objectives and advantages of the present invention will become clearer when referring to the following detailed description of preferred embodiments made with reference to the accompanying drawings in which:

FIGURE 1 is a front perspective view of a prior art airport runway or taxiway light fixture;

FIGURE 2 is a front perspective view of a first embodiment of illuminated marker or indicium being used as a boundary edge;

FIGURE 3 is a top right perspective view of a second embodiment of indicium used at a pavement/boundary intersection;

FIGURE 4 is a top front perspective view of a third embodiment of indicium for an alternative pavement/boundary intersection marker;

FIGURE 5 is a front perspective, sectional view of a fourth embodiment of indicium for identifying a pavement edge;

FIGURE 6 is a top perspective, solid view of a fifth embodiment of indicium for an alternative pavement edge marker;

FIGURE 7 is a top perspective view of multiple indicia according to this invention being used to outline a pathway for on ground airport traffic; and

FIGURES 8a and b are top and bottom comparisons showing two sets of multiple airport lights as used before the invention (FIGURE 8a) and with indicia of this invention installed there on (FIGURE 8b).

DRAWINGS – REFERENCE NUMERALS

Indicium: 110, 210, 310, 410, 510	Pivot Point: 178, 278, 578
Radial Arm/Light Diffuser: 115, 115L, 115R, 215, 215A, 215B, 215C, 315, 415	Vertical Spar: 20, 120, 220A, 220B, 220C, 320, 420, 520

Luminaire Light Source: 50, 150, 250, 350	Round Base Plate: 30, 130, 230A, 230B, 230C, 330, 430, 530
Traditional omni directional luminaire: 10	Adapter: 180
Reflective surface: 518	Boundary, Edge, Obstruction: 125, 225, 425, 525

Description of Embodiments

[0016] It should be noted that common features in the different views of this invention are shown with the same reference numeral(s). For alternate embodiments of the same component, there is consistent numbering though in the next hundred series.

Examples

[0017] Referring to a first embodiment of the present invention, FIGURE 2 shows an indicium, generally 110, said indicium including a plurality of radial arms 115, which may be flexible or rigid. In either case, arms 115 are mounted to a central support or vertical spar 120 extending upwardly from a traditional light base plate 130 similar to the base plate for prior art model L-867 described above (at FIGURE 1). The luminaire/light source 150 sitting atop vertical spar 120 allows a properly sized and shaped indicium 110 (either straight or curved), to serve as a visual cue/marker/signal or indicator relating to the airport pavement boundary/edge 125 it represents. Per FIGURE 2, indicium 110 has a generally straight configuration when viewed from the top. It is to be understood, however, that if intended to show a pavement edge or boundary 125 that may be somewhat curved, indicium 110 may itself take on an overall curved shape or profile.

[0018] As shown in FIGURE 2, each radial arm 115 of indicium 110 is constructed as a static object resembling a tube, pipe, baton, channel, conduit, duct, hose or other light conducting media. These radial arms 115 are suspended from opposed sides, or in a counterbalanced manner, more particularly as left arm 115L and right arm 115R. The combination of arms 115 aligns collinearly with the pavement edge 125 that this particular indicium 110 is designed to protect. It is understood, however, that with the present invention, it is possible for indicium to have two or more radial arms from other than opposite sides for indicating/protecting airport runway/taxiway intersections and the like.

[0019] Radial arm 115, as an object, may be constructed as a solid translucent, light conducting material or hollow body, closed at both ends and fitting over the top half to domed illumination source 150 of an existing runway/taxiway marker. An alternative embodiment of this invention would also allow for full coverage of the radial arm units completely over an

existing marker's illumination source. On a preferred basis, the radial arms 115 of this invention are fitted with their own internal illumination source (not shown), said source including internal light manipulating elements like mirrors and/or lenses for creating an optimum homogenous distribution of light distribution from within the body of radial arm 115.

5 [0020] Representative internal illumination sources for radial arms 115 may include one or more self-illuminating sub-elements such as an incandescent filament, laser, optical fiber bundle, LED, filament of ionized gas, fluorescence and/or stimulated emission of radiation. It is preferred that any such light source 150 illuminate the entire length of each radial arm 115.

10 [0021] One or more pigments may be added to the translucent material used for making radial arm 115 so that when said arm 115 covers an existing illumination source 150 or has its own self-illuminating unit inside, the resulting indicia color matches an approved code or other desired result. Alternately, each sub branch to radial arm 115 may be differently tinted for the same indicium 110 to provide greater levels of boundary information to pilots and other airport personnel.

15 [0022] Indicium 110 can be affixed with a clamp (not shown) for sealing same to the vertical spar 120 thus protecting the internal electrical connection as it transitions from base plate 130 to illumination source 150. Per FIGURE 2, the longitudinal axis of indicium 110 is oriented parallel or tangent to the boundary/edge 125 it is protecting. A pivot action connector with a keyed flute, indexing dial or detent, aids in realignment of indicium 110 with the intended
20 boundary edge 125 after maintenance is performed. A precise pivot point 178 about the y-axis is collocated with clamp (not shown) or another quick disconnect device nearest the top of vertical spar 120.

[0023] Like the model at FIGURE 1 - Prior Art, the vertical spar 120 of indicium 110 connects to its base plate 130 via an adapter 180. In a typical installation, there would be a
25 transformer (not shown) below base plate 130, encased in the ground and connected to electric wires. Like earlier counterparts, the intensity of illumination source 150 within indicium 110 may be made adjustable by conventional methods. And though not shown, it is understood that any embodiments of this invention may be fitted with spiked regions and/or other physical deterrents for preventing birds from roosting on same.

30 [0024] In the operation of this first embodiment, indicium 110 is counterbalanced over a single mount, via pivot point 178 and about a seal (not shown). Such mounting allows indicium 110 to be rotated for maintenance servicing purposes, snow removal and/or lawn maintenance about the spar 120 and base plate 130. Arrow A, in FIGURE 2, shows one direction of rotation for that particular indicium 110.

[0025] As seen in accompanying FIGURES 7 and 8b, the normal position for indicium 110 is aligned with the pavement edge 125 it is meant to represent. Preferably, the spacing between adjacent indicia 110-2, 110-3 decreases as the ratio of change in the angle of a tangent moving over a given arc to the length of that arc increases. And the overall length of indicia 110-2, 110-3 may decrease as the spacing between adjacent spars (or lighting units) decreases.

[0026] When viewed from a distance of several meters, indicia 110 will mark the immediate termination of a boundary. From a greater distance, the short sequencing of discontinuous lines allows the brain to efficiently interpolate line sequences (i.e. filling in the dashed lines) thereby creating a more complete, linearly connected outline. The combination of light fixtures so described creates an accurate representation of all pavement edges 125. See, especially, the differences in lighting units before and after installation according to this invention in the top and bottom, comparative side views of several consecutive lighting units at FIGURES 8a and b. When used with existing pavement signs, and other visual cues, individual pilot awareness will be enhanced and overall safety orientation improved.

[0027] Another benefit from the designs of this invention is that any heat produced by illumination source 150 of indicium 110 will suffice in preventing snow and ice from accumulating thereon. For airports that experience substantially greater, extreme snowfall situations, a supplemental controlled internal heat source may be added.

[0028] In FIGURE 3, there is shown a second embodiment of indicium 210 having a plurality of radial arms 215, or in this case, three arms 215A, 215B and 215C. Said radial arms 215 can be made flexible or rigid, but, in any event, the joined/combined arms all mount to their respective vertical spars 220A, 220B and 220C, each of which rises from their respective, centrally located, traditional base plates 230A, 230B and 230C. And while the individual arms 215 of FIGURE 3 are shown substantially straight in a side (or top) profile, it is understood that other embodiments of airport runway and taxiway lighting may enable the used of curved or wavy alternatives.

[0029] Radial arms 215A, 215B and 215C of FIGURE 3, are duly sized and shaped, (either in a straight or somewhat curved configuration), to provide pilots and other airport personnel with a visual cue/indicator/signal relating to the pavement edge or boundary 225 they represent. For this particular embodiment, edge/boundary 225 is more of an intersection or crossroad on the airport runway/taxiway. Radial arms 215A, 215B and 215C are each constructed from a static object tube, pipe, baton, channel, conduit, duct, hose or other light conducting media, and all interconnected at one common, centrally situated end.

[0030] In this first intersection alternative, each radial arm 215 includes its own internal,

self-illumination source 250 which may or may not include internal light manipulating mirrors and/or lenses (not shown) for creating an optimum homogenous light distribution inside indicium 210. That self-illuminating light for illumination source 250 may be selected from the group consisting of: an incandescent filament, laser, optical fiber bundle, LED, a filament of
5 ionized gas, fluorescence, stimulated emission of radiation or combinations thereof.

[0031] In this second overall alternative, each internal terminal end to radial arm 215A, 215B and 215C appears to be permanently attached. But such an attachment would preclude using a common pivot for maintenance access. Alternately, a common pivot action point 278 (with a keyed flute, indexing dial or detent) may be provided. That pivot point 278 would assist
10 maintenance personnel with properly realigning indicium 210 after maintenance has been performed. Even though the attachment point for this embodiment would not be permanent, the rotation of one radial arm 215 can be made possible without conflicting with the structure of adjacent radial arms.

[0032] Yet another alternative marker to the embodiment of FIGURE 3 is shown in
15 accompanying FIGURE 4. Therein, alternate indicium 310 is constructed of two or more radial arms 315, (either flexible or rigid), each of which connects to its own vertical spar 320 rising up from its own base plate 330. Unlike the separate, tubular radial arm configuration in preceding FIGURE 3, however, these alternative radial arms 315 appear to be suspended by, span between and at least partially cover or cap over adjacent luminary posts from pre-existing airport
20 runway/taxiway marker units.

[0033] In FIGURE 4, a light illumination source 350 enclosed within should properly illuminate the entire length of its radial arm 315. Only then can indicium 310 serve as part of a *system* of illuminated indicators for allowing the human brain to efficiently interpolate line sequences (between adjacent indicium) and thus create a more complete, visual “picture” of a
25 runway/taxiway boundary.

[0034] A fourth embodiment of indicium 410 depicted in FIGURE 5 has its own set of radial arms 415, both of which are suspended and counterbalanced over a shared vertical spar 420 that rises up from its own base plate 430. Altogether, the radial arms 415 of this indicium 410 will align collinearly with the pavement edge 425 they are assigned to protect. In this
30 variation, separately illuminating radial arms 415 will be mounted eminently about, above or below, for including traditional luminaire with existing, FAA approved, airport lighting systems for greater pilot vision-enhancements. When such radial arms 415 are situated and clamped into place, they will promote greater omni-directional viewing of that luminaire from a distance. Viewed from a distance of several meters, indicium 410 marks the immediate termination of its

boundary/edge 425. But when viewed from greater distances, a plurality of such indicia 410 allow the human brain to interpolate sequences of discontinuous line segments thereby creating a more accurate representation of pavement edges/boundaries for a region of airport traffic similar to that seen in accompanying FIGURE 8b.

5 [0035] The fifth embodiment, at FIGURE 6, shows an indicium 510 having a rigid, elongated reflector 518 attached to opposed sides of vertical spar 520 that rises up from base plate 530. Each reflector 518 is constructed as a solid, light-reflecting media that would be illuminated by an external light source. Like earlier illuminated radial arm counterparts, the size and shape of reflectors 518 will provide a visual cue to pilots that better simulates the airport
10 pavement boundary/edge 525 it is designed to protect. With the mounting of reflective, horizontally extending surfaces to a traditional luminaire, by retrofit or by integral inclusion with the manufacture of new luminaire, there will be greater pilot vision-enhancements. In the latter operation, each indicium 510 would be affixed with reflective “wings” using one or more clamps (not shown). Alternately, models of indicia may be made with integrally formed,
15 permanently mounted reflectors.

[0036] Preferably, there is provided a pivot point 578 about each vertical spar 520 that allows the reflectors 518 to be rotated out of harm’s way for maintenance purposes, snow removal, and/or lawn maintenance. A main source for illuminating the reflectors 518 of indicia 510 can be the light from an approaching vehicle, illumination from adjacent lights and/or
20 reflection from the sun’s electromagnetic radiation. And like earlier, self-illuminating counterparts, it is preferred that the spacing of reflector-based indicia 510 be decreased as the ratio of the change in the angle of a tangent that moves over a given arc to the length of the arc increases. In addition, the length of each reflector arm may be incrementally decreased as the spacing between adjacent indicia 510 decreases. And while the minimal surface area atop each
25 reflector 518 may be sufficient for preventing snow and ice accumulations thereon under most conditions, in higher snow markets, the indicium 510 may have a supplemental heater component added thereto.

[0037] Referring now to FIGURE 8b, when the devices of this invention are viewed from a distance of several meters, the indicia 110 mark the immediate termination of airport
30 pavement boundary 125. When viewed from a greater distance, a plurality of indicia 110 allows the brain to interpolate the sequences of discontinuous line segments from all indicia, or “connect the dashes” thereby creating a more accurate representation of the actual, official border to all pavement edges in sight. When used in conjunction with existing in-pavement lights, signs, and other existing visual cues; orientation is enhanced, hence safety is improved.

[0038] According to one embodiment of the invention, there is provided a three-dimensional elongated marking referred to as an indicium. Such marker indicia provide a much needed additional visual cue for the human brain to effectively recognize the pavement edge or other boundary. While the above description contains much specificity, these should not be construed as limitations on the scope of any embodiment, but as exemplifications of the presently preferred embodiments thereof. Many other ramifications and variations are possible within the foregoing teachings. For example, the pivot point about the y-axis in the first embodiment may be located at the base of its vertical spar. Alternatively, each indicium may contain a coupling that would allow for full axial rotation for maintenance and/or servicing. Also, it should be understood that the size, shape and illumination method for any such indicium can take on countless forms to best represent an airport's runway or taxiway boundary. They may assume an elongated, pentagonal shape, be coated with reflective paints and/or illuminated from an external source. Such indicia can be left open at one or both ends and/or attached to objects other than a traditional L-867 base. Still further, the indicium of this invention may be designed for at least some partial embedding into the ground. Thus the scope of the invention should be determined by the appended claims and their legal equivalents, and not by the examples given hereinabove.

What is claimed is:

1. An improved boundary/edge marker for on ground vehicle traffic, said marker comprising:

(a) means for securing the marker to a ground surface;

5 (b) a rigid structural support extending upwardly from the marker securing means;

(c) an illuminated region connected to the rigid structural support, said illuminated region being a boundary or edge indicator visible from a plurality of angles; and

10 (d) an elongated, three-dimensional indicium oriented substantially parallel or tangential to a boundary/edge of permissible on ground vehicle traffic, said indicium extending outwardly from at least one side of the illuminated region to serve as a visual extension of the illuminated region.

2. The on ground traffic boundary/edge marker of claim 1 wherein said indicium extends outwardly from two or more sides of the illuminated region.

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3. The on ground traffic boundary/edge marker of claim 2 wherein said indicium is at least partially self-illuminating, reflective or both.

20 comprising:

(a) means for securing the marker to the airport runway or taxiway;

(b) a rigid structural support extending upwardly from the marker securing means;

(c) an illuminated region connected to the rigid structural support, said illuminated region being a boundary or edge indicator visible to humans from a plurality of angles; and

25 (d) an elongated, three-dimensional indicium oriented substantially parallel or tangential to the boundary/edge of the airport runway or taxiway, said indicium extending outwardly from at least one side of the illuminated region to serve as a visual extension of the illuminated region.

30 5. The airport boundary/edge marker of claim 4 wherein said indicium extends outwardly from two or more sides of the illuminated region.

6. The airport boundary/edge marker of claim 5 wherein said indicium extends outwardly from opposed sides of the illuminated region.

7. The airport boundary/edge marker of claim 4 wherein said rigid structural support includes a vertical spar onto which said indicium is counterbalanced.

5 8. The airport boundary/edge marker of claim 4 wherein said indicium includes means for rotating from an operating position to at least one other position for facilitating individual marker or airport maintenance.

10 9. The airport boundary/edge marker of claim 4 wherein said indicium extends radially in multiple directions to indicate an intersection of the airport runway or taxiway.

15 10. The airport boundary/edge marker of claim 4 wherein said indicium includes a self-illuminating element selected from the group consisting of: a fiber optic bundle, a light emitting diode (LED), an incandescent filament, ionized gas, fluorescence, stimulated radiation emission and combinations thereof.

 11. The airport boundary/edge marker of claim 4 wherein said indicium includes at least one straight or curved, hollow body element.

20 12. The airport boundary/edge marker of claim 11 wherein said hollow body element is at least partially color-coded for an intended use.

25 13. The airport boundary/edge marker of claim 11 wherein said hollow body element is sized to fit at least partially over the illuminated region of a pre-existing boundary/edge marker for retrofitting.

 14. The airport boundary/edge marker of claim 4 wherein said indicium includes multiple reflector elements.

30 15 A system for visually extending a boundary/edge marker of an airport runway or taxiway, said system comprising:

 a plurality of marker units oriented substantially parallel or tangential to a boundary/edge of the airport runway or taxiway, each marker unit comprising:

 (i) means for securing the marker to the airport runway or taxiway;

- (ii) a rigid structural support extending upwardly from the marker securing means;
- (iii) an illuminated region connected to the rigid structural support, said illuminated region being a boundary/edge indicator visible to pilots from a plurality of angles; and
- (iv) an elongated, three-dimensional indicium oriented substantially parallel or tangential to the boundary/edge of the airport runway or taxiway, said indicium extending outwardly from at least one side of the illuminated region to serve as a visual extension of the illuminated region;

said system further comprising:

preset void distances between adjacent marker units, said void distances encouraging cognitive interpolation of indicia as a simulated line sequence for better identifying the airport runway or taxiway boundary/edge.

16. The system of claim 15 wherein the length of indicium decrease as the void distance between adjacent marker units decreases.

17. The system of claim 15 wherein:

(i) each marker unit for indicating a boundary/edge of the airport runway or taxiway has indicia that extend outwardly from opposed sides of their illuminated regions; and

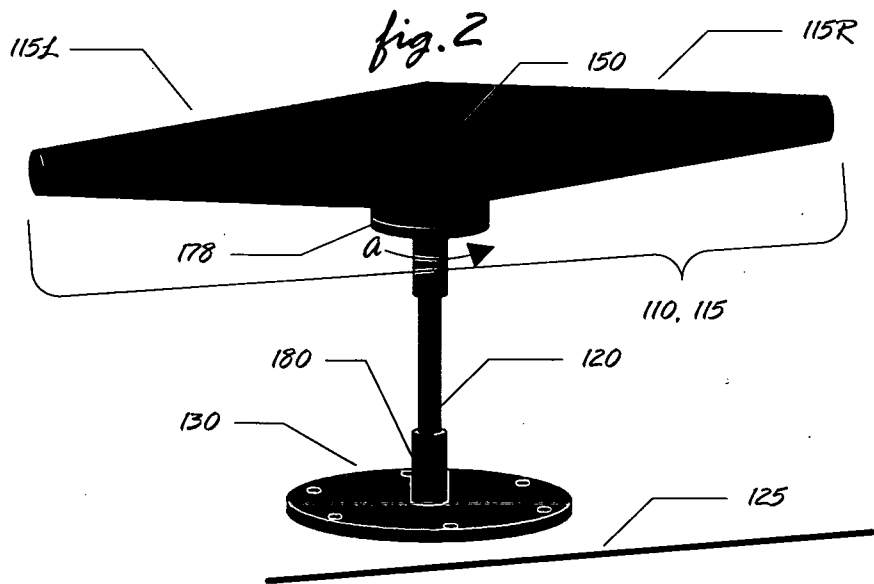
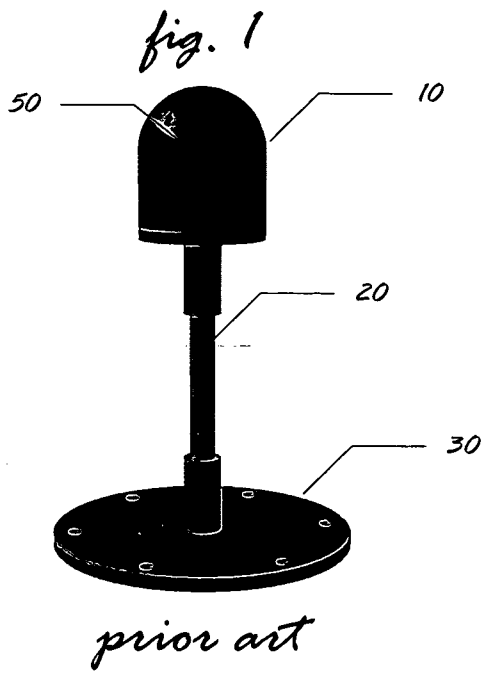
(ii) each marker unit for indicating an airport runway or taxiway intersection has indicia that extend radially in multiple directions.

18. The system of claim 15 wherein at least several marker units have indicia with a self-illuminating element selected from the group consisting of: a fiber optic bundle, a light emitting diode (LED), an incandescent filament, ionized gas, fluorescence, simulated radiation emission and combinations thereof.

19. The system of claim 15 wherein at least several marker units have indicia with a plurality of reflector elements.

20. The system of claim 15 wherein certain indicia include a hollow body element sized to fit at least partially over the illuminated region of a pre-existing boundary/edge marker for retrofitting.

115



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fig. 3

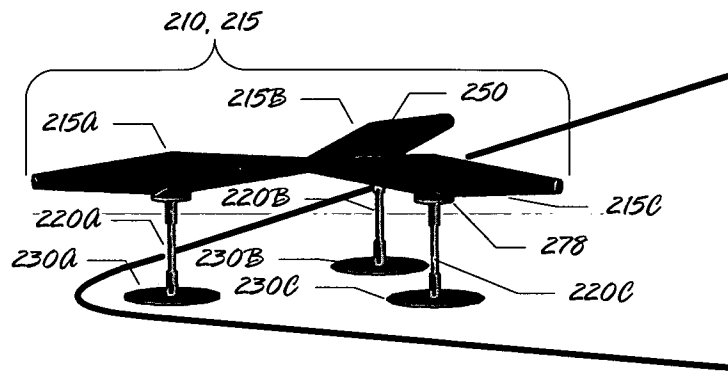
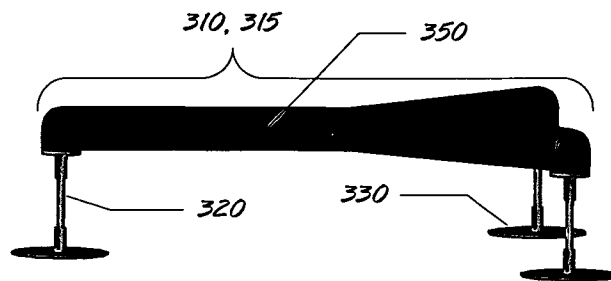


fig. 4



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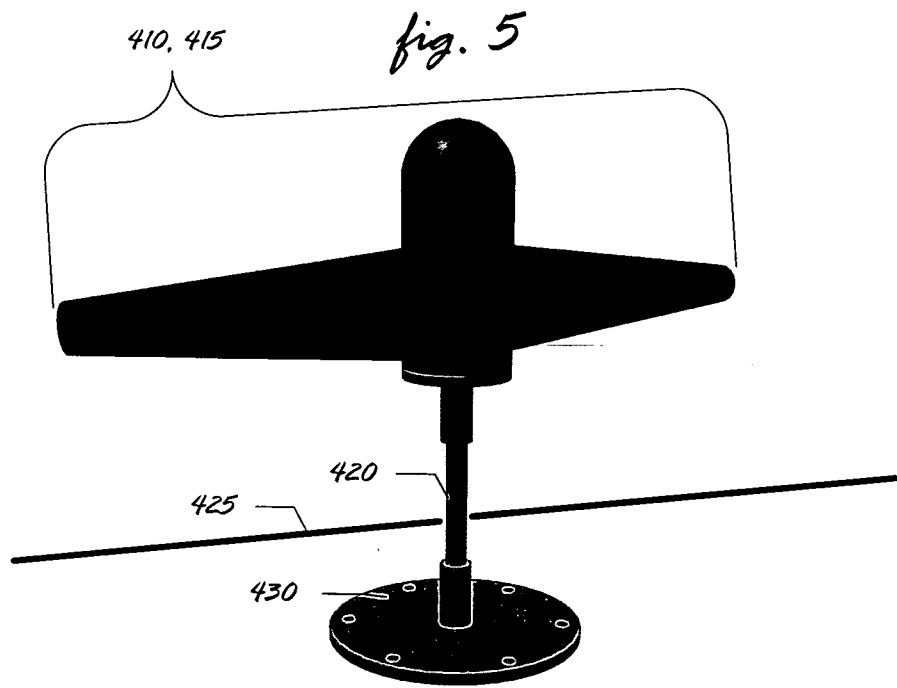
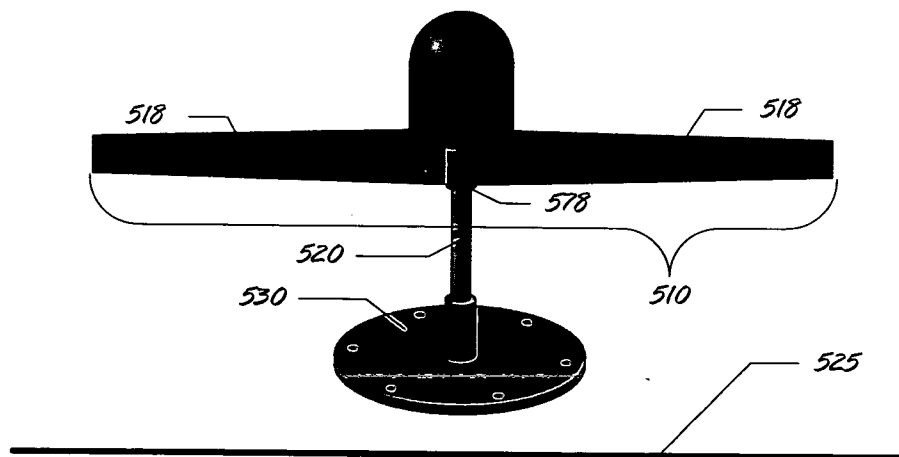
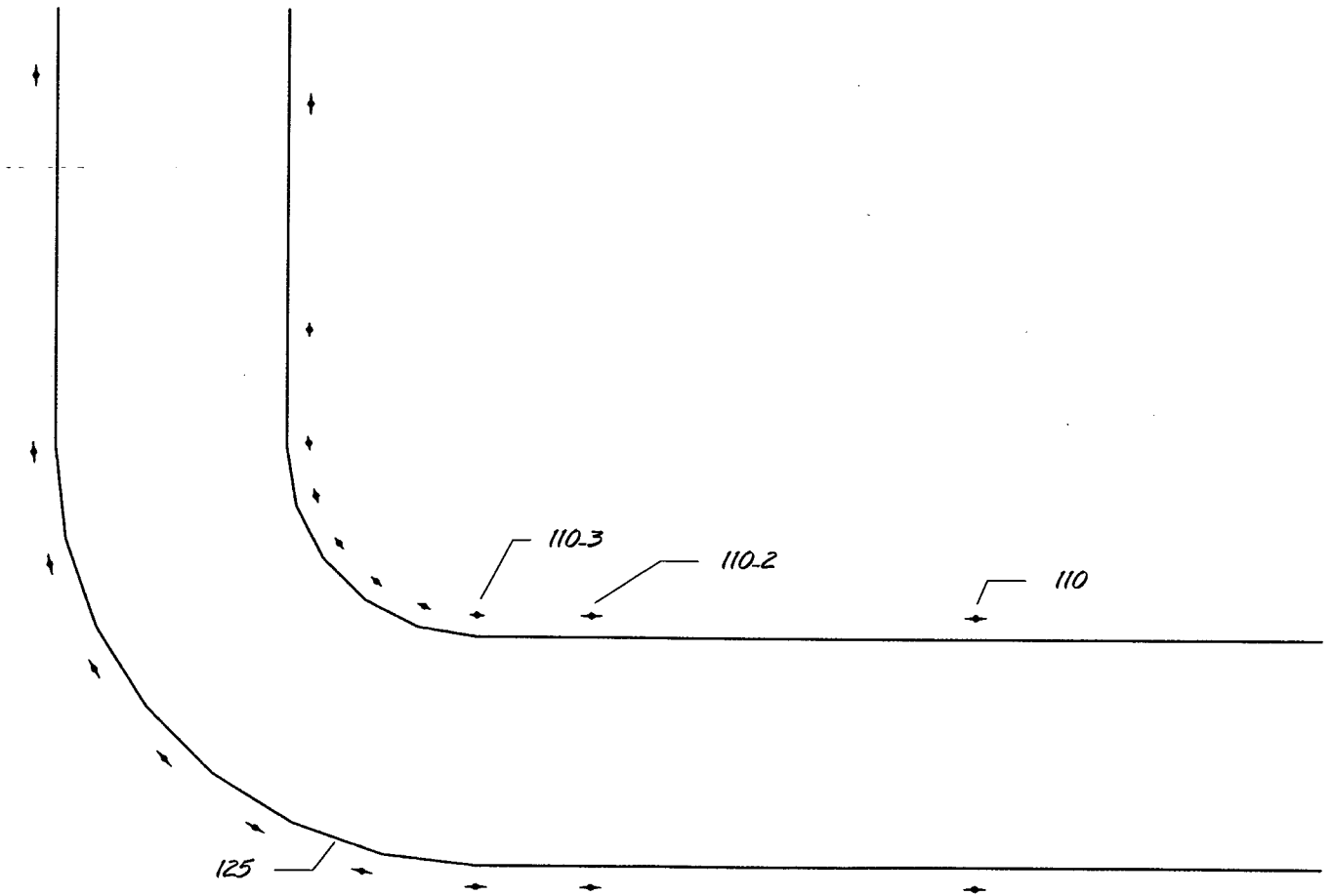


fig. 6



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fig. 7



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fig. 8A

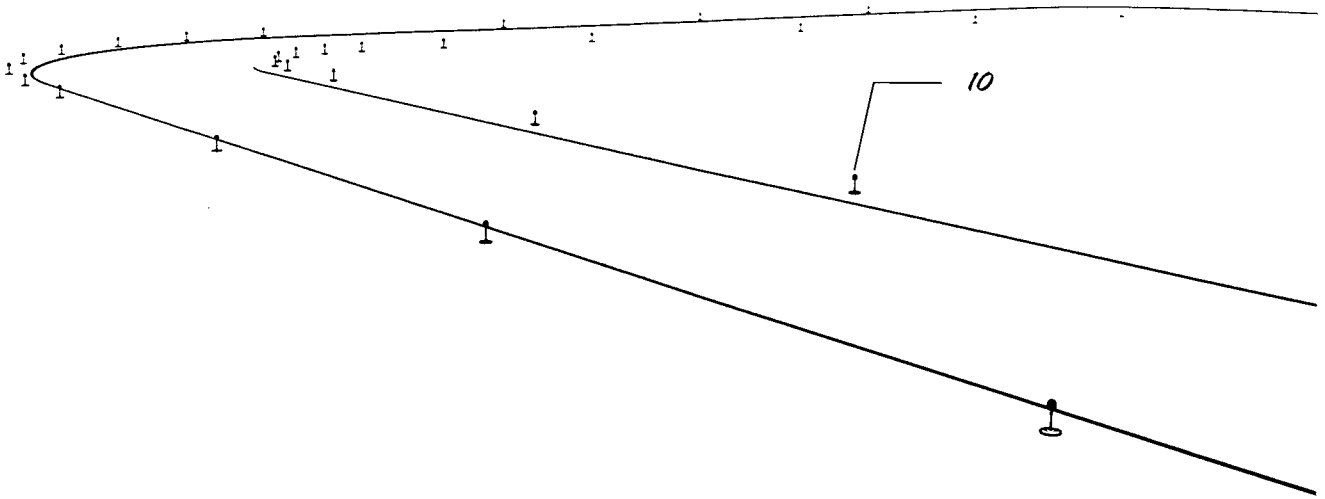
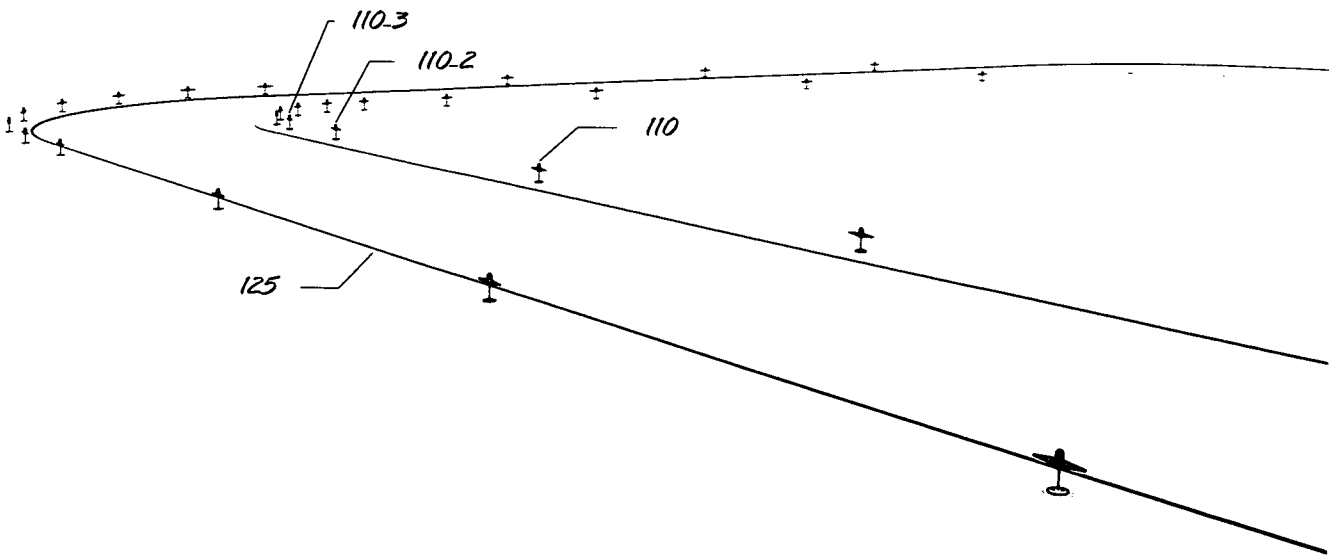


fig. 8B



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 10/02280

A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - G08G 5/00 (2010.01) USPC - 340/947 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC(8): G08G 5/00 (2010.01) USPC: 340/947 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched USPC: 340/945, 950, 951, 989; 359/515, 529, 531, 532, 543; 362/257; 362/\$ Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PubWEST (USPT, USOCR, PGPB, EPAB, JPAB); Google/Patents; Google/Scholar; EPO Espacenet Search terms: airport, runway, taxiway, taxi, aircraft, aviation, edge, boundary, limit, light, illuminate, lamp, beacon, post, stand, base, pedestal, support, color, colour, reflect, space, stagger, void, align, line, lining, sequence, retrofit, horizontal, sid		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 1,876,082 A (SHAW et al.) 06 September 1932 (06.09.1932), page 1, lns 33-45, 68-83; page 2, lns 58-64, 79-91; Figs. 1-2	1-20
Y	US 5,751,226 A (HRETSINA) 12 May 1998 (12.05.1998), col 1, lns 3-6; Figs. 2, 4	1-20
Y	US 2003/0160708 A1 (KNOOP) 28 August 2003 (28.08.2003), para [0025], [0038]; Figs. 1A, 1B, 2, 3	9, 17
Y	US 2,734,180 A (PENNOW) 07 February 1956 (07.02.1956), col 1, lns 15-19; col 10, lns 35-38; Figs. 1-2	10, 16, 18
Y	US 4,562,517 A (PANKIN) 31 December 1985 (31.12.1985), ol 4, lns 31-38; col 9, lns 65-69; col 10, lns 1-5; Fig. 13	13, 20
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/>		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 29 September 2010 (29.09.2010)		Date of mailing of the international search report <p align="center" style="font-size: 1.5em;">12 OCT 2010</p>
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201		Authorized officer: <p align="center">Lee W. Young</p> PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774