(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 September 2016 (15.09.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/145054 A1

(51) International Patent Classification:
A44B 11/25 (2006.01) *B60R 22/48* (2006.01)

(21) International Application Number:
PCT/US2016/021523

(22) International Filing Date:
9 March 2016 (09.03.2016)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/132,117 12 March 2015 (12.03.2015) US

(71) Applicant: **KEY SAFETY SYSTEMS, INC.** [US/US]; 7000 Nineteen Mile Road, Sterling Heights, Michigan 48314 (US).

(72) Inventors: **RRUMBULLAKU, Besi**; 1155 Sycamore Drive, Rochester, Michigan 48307 (US). **SIKORSKI, Jeffrey**; 12877 Glenmore Court, Plymouth, Michigan 48170 (US).

(74) Agent: **SEITZMAN, Markell**; 7000 Nineteen Mile Road, Sterling Heights, Michigan 48314 (US).

(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, BN, 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, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, 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, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, 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, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

WO 2016/145054 A1

(54) Title: SEAT BELT BUCKLE WITH RFID TAG

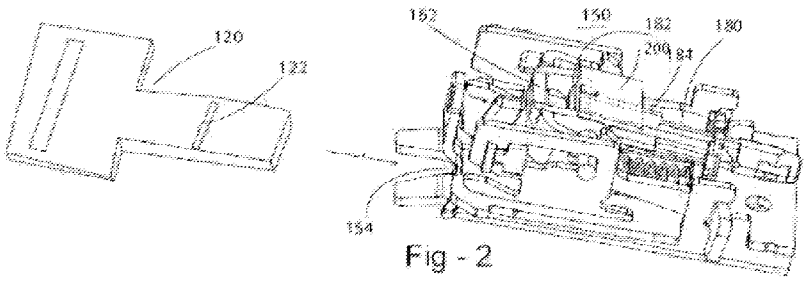


Fig - 2

(57) Abstract: A system for use primarily with removable vehicle seats comprising: a removable vehicle seat (100); a seat belt buckle (150) secured to the seat (100), the buckle (150) including: a passage to receive a tongue (120); a first part movable in response to the introduction of the tongue (120) into the buckle (150) from a first position to a second position; an RFID tag (200) movable with the first part to corresponding first and second positions; an RFID reader (204) located remote from the seat; an EM shield (214) mounted in the buckle (150) to shield the RFID tag (200) from EM radiation when the RFID tag (200) is in the first position and to not block the RFID tag (200) from EM radiation when the RFID tag (200) is in the second position.

Seat Belt Buckle with RFID Tag

BACKGROUND AND SUMMARY OF THE INVENTION

[0001] The present invention generally relates to an improved method of repositioning certain seats from an automotive vehicle, in particular one or more of the rear seats. In general these seats may be removable or slidable or foldable to a storage position. More particularly, the present invention is related to a shielded RFID tag which is part of a buckle secured to the seat.

[0002] In the past vans and other automotive vehicles permitted the removal of the rear seats to temporarily increase storage room or permitted the seats to slide or fold into a storage position. At one point in time the shoulder belt was secured to the side of the vehicle and removal of the seat required removal of the entire or at least part of the seat belt system. Also, seat belt buckles have for many years included an electric or magnetic switch which changes state when a tongue is mated with the buckle. Quite often when the seat was removed this required the disconnection of two mating electrical connectors. Reinsertion of these seats into the vehicle required reestablishment of electrical contact which might not have been done all the time. The reestablishment of electrical contact also reduces electrical conductivity of the contact after many removal cycles.

[0003] The present invention includes: a system for use primarily with repositionable vehicle seats comprising: a repositionable vehicle seat; a seat belt buckle secured to the seat, the buckle including a passage to receive a tongue, a first part movable in response to the introduction of the tongue into the buckle from a first position to a second position; an RFID tag movable with the first part to corresponding first and second positions; an RFID reader located remote from the seat; an EM shield mounted in the buckle to shield the RFID tag from EM radiation when the RFID tag is in the first position and to not block the RFID tag from EM radiation when the RFID tag is in the second position.

Brief Description of the Drawings

[0004] Figure 1 shows a rear vehicle seat usable with the present invention. Figure 1 also shows in phantom line the electrical connector that would have to be disconnected if a prior art seat belt buckle was used.

[0005] Figure 2 shows a seat belt buckle that has incorporated the present invention.

[0006] Figure 3 is an underside view of the buckle of figure 2 showing amongst other things a movable ejector.

[0007] Figure 4 is a side view of a seat belt buckle incorporating the present invention; the buckle is shown in its unlocked or unlatched state.

[0008] Figure 5 is a side view of the seat belt buckle incorporating the present invention; the buckle is shown in its locked or latched state.

[0009] Figure 5A is a cross-sectional view of the buckle in figure 5 and more clearly shows the placement of an RFID tag.

[0010] Figures 6 and 6A show the basic operation of the present invention.

[0011] Figures 7 and 8 show an alternate embodiment of the invention.

Detailed Description of the Drawings

[0012] Reference is briefly made to figure 1 which shows an automotive rear seat 100 having a seat back 102 and a seat cushion 104. Seat 100 includes a three-point seat belt system 106 which includes a shoulder belt 108 and a lap belt 110. The lap belt is secured to a seat frame 112 by an anchor 114. The seat belt system 106 includes a tongue 120 slidably received upon the shoulder belt/lap belt. As is known in the art the tongue can be permanently secured to these belts. The tongue 120 is inserted within a seat belt buckle 140 or 150 which is secured by an anchor 122 to the seat frame 112. As shown in phantom line, buckle 140 includes an RFID tag 200. By way of illustration, figure 1 also shows in phantom line an electric connector 400 and an associated wire 402 which, as mentioned

above, is illustrative of an older type of removable seat and not part of the present invention. Figure 1 also shows an RFID reader 204 secured to some determinate location in the vehicle.

[0013] Reference is briefly made to figures 2 and 3 which illustrate a seat belt buckle 150 incorporating the present invention. Positioned to the side of the buckle 150 is a tongue 120. Figure 2 illustrates the unlatched or unlocked configuration of the buckle. Common to buckle 150 and other buckles is a frame 152 which is designed to provide a channel 154 into which tongue 120 is inserted. As the tongue is inserted it contacts an ejector 156 which is spring loaded by spring 158. Rearward motion of the tongue and the ejector, see arrow 156a, initiates the locking action of the buckle. Many buckles as well as buckle 150 include a lock plate 162 which is configured to move downwardly as tongue 120 is inserted within the buckle to its latched position. In the latched position or condition, the lock plate will extend through an opening such as 170 in the frame as well as a complementary opening 122 in the tongue. The specific locking and unlocking description of buckle 150 is not included herein, however reference is made to European patent EP 1025774B1 which shows a similar buckle and which is incorporated herein by reference.

[0014] Buckle 150 is illustrative of many other seat belt buckles in that as the mode of operation of the buckle switches from an unlatched condition to a latched condition various components move in an axial direction. Axis 172 is shown in figure 3. As previously mentioned the ejector 156 moves axially. In addition buckle 150 includes a linear guide 180 as well as an engagement part 182. These mechanisms correspond to numerals 21 and 25 in the above patent. The guide 180 and engagement part are associated with the latching or locking of the buckle. In figure 2 the engagement part 182 and linear guide 180 are shown closer to the front of the buckle. An RFID tag 200 is shown secured to the linear guide 180 and engagement part 182. In figure 3, ejector 156 is shown positioned closer to the front of the buckle. Also in another embodiment, the RFID tag 200 is shown in phantom line secured to the ejector.

[0015] In the present invention the motion of the linearly movable components is sensed utilizing RFID technology. The present invention can be used in another way which is to sense the presence or lack thereof of a removable seat. For example, with the seat removed from the vehicle the RFID tag will not generate a signal or generate a rather diminished one. Also if the seat is folded or slid into a stored position in the vehicle the EM signal from the RFID reader will be reduced in strength and the RFID tag will generate no signal or a reduced signal to the RFID reader.

[0016] RFID technology uses a radio frequency identification tag, or RFID tag and a radio frequency reader. The identification tag or tag is frequently comprised of a microchip with an antenna. Similarly the reader has another microchip with its corresponding antenna. The reader sends out radio-frequency waves at a predefined frequency forming a magnetic field which is received by the antenna on the RFID tag. A passive RFID tag absorbs power from this magnetic field and uses it to energize the circuits of the microchip on the RFID tag. The chip or microchip sends information back to the reader in the form of radio-frequency waves, in essence identifying that the RFID chip has responded to the signal sent from the reader. The RFID reader converts the new waves into digital information which is then turned into other useful information. The present invention proposes the use of the passive RFID tag. RFID tags can be categorized as active tags or semi-passive, semi-active tags.

[0017] Reference is again made to figure 2. As can be seen the linear guide 180 is a cylindrical part that terminates in the engagement part 182 which is situated perpendicular to the central axis of the linear guide 180. In the present invention and as shown in figure 2 a passive RFID tag 200 is secured to the top of the engagement part 182 as well as to the top of a thin wall 184 of guide 180. The RFID tag is linearly movable with part 182 and guide 180.

[0018] Reference is made to figures 4, 5 and 5A which show various features of the present invention. As mentioned above the RFID tag is secured to the top of engagement part 182 as well as to the thin wall 184,

this relationship is more clearly shown in figure 5A which is a cross-sectional view. In figures 4 and 5 the seat belt buckle 140 is shown encapsulated by the buckle cover 250. In figure 4 the tongue 120 is in the process of being placed within the buckle; this action will change the state of the buckle from unlatched to latched. Also as the buckle changes its state a variety of components of the buckle will change their relative position. For example the RFID tag 200 shown in figure 4 is further away from the front of the cover than it is in figure 5 which is the latched position. Additionally the ejector 156 is shown in figure 4 positioned closer to the front of the cover 250 in its unlatched condition. These figures also diagrammatically show a push button 260 associated with the buckle.

[0019] Typical of buckle buttons 260 this button includes at least one or perhaps two ramped surfaces 262 extending from the back of the buckle in a known manner. Each ramped surface engages a portion of the buckle latch. When the button is moved inwardly the ramped surface(s) lifts the latch causing the buckle to change state from a latched to an unlatched condition. As is also known in the art the button is biased outwardly by a spring which is not shown.

[0020] Reference is made to figures 6 and 6A which show the basic operation of the present invention. In figure 6 an RFID reader 204 with its antenna is shown connected to a computer such as an onboard vehicle computer or module 208. Antenna 206 is generating an RFID signal generally shown as 210 which propagates to the RFID tag 200 with its corresponding antenna 202. The incoming signal 210 excites antenna 202 which in turn generates a responsive signal 212 which is sensed by the antenna and by the circuitry in the microchip included as part of the reader 204. This information is communicated to the onboard computer 208. This information can simply state that the RFID tag 200 is near the reader 204 (in the case of the present invention the buckle is in a locked condition). Alternatively the communicated information may include details of the structure to which the RFID tag is secured (the particular seat in the rear of the vehicle). In figure 6A an EM shield or structure 214 has been placed in

between reader 204 and tag 200; the material of the structure 214 has been chosen to block or shield the RFID signal emanating from antenna 206 from contacting the antenna 202. Consequently, with this shielding structure 214 in place the RFID tag cannot be excited. As an alternate embodiment the material of the shielding structure can be chosen to weaken the signal and not block it totally.

[0021] Reference is again made to figures 4 and 5. The shielding structure 214 has been placed on the inside of the top portion of the cover. This shielding structure is frequency sensitive and its material can be as simple as tin or aluminum foil or isolating plastic or a flexible composite metal and plastic material. As can be seen in the unlatched condition the shielding structure 214 totally or partially shields RFID tag 200 from any incoming radiation (indicating the buckle is not latched) while in figure 5 with the tag 200 displaced away from structure 214 the tag is free to receive incoming radiation from the reader 204 indicating the buckle is latched. Reference is again briefly made to figure 1 which diagrammatically illustrates an RFID reader 204 with antenna 206 secured to a portion of the vehicle. For example, the RFID reader will be in or on the floor or inside a side trim panel.

[0022] Reference is briefly made to figures 7 and 8 which show an alternate embodiment of the invention. Figure 7 shows the buckle in an unlocked position and figure 8 shows the buckle in a locked position. In both figures 7 and 8 an RFID tag 200 has been secured to ejector 156. The shielding structure 214 in figures 7 and 8 is positioned proximate the ejector 156. In figure 7 the shielding structure totally or partially shields the RFID tag 200 from incoming radiation. In figure 8 the ejector has been withdrawn rearward by insertion of tongue 122 to a new position apart from the shielding structure 214 so it may receive incoming EM radiation.

[0023] Many changes and modifications in the above-described embodiment of the invention can, of course, be carried out without departing from the scope thereof. Accordingly, that scope is intended to be limited only by the scope of the appended claims.

Claims

1. A system for use primarily with vehicle seats of the type that are removable, foldable or slidable to a stored condition in the vehicle, the system comprising:

a vehicle seat (100);

a seat belt buckle (140, 150) secured to the seat (100), the buckle (140, 150) including

a passage to receive a tongue (120);

a first part movable in response to the introduction of the tongue (120) into the buckle (140, 150) from a first position to a second position;

an RFID tag (200) movable with the first part to corresponding first and second positions;

an RFID reader (204) located remote from the seat;

an EM shield (214) mounted in the buckle to totally or partially shield the RFID tag (200) from EM radiation when the RFID tag (200) is in the first position and to not block the RFID tag (200) from EM radiation when the RFID tag (200) is in the second position.

2. The system of claim 1 wherein the first movable part is associated with the locking function of the buckle (140, 150) or associated with an ejector (156).

3. The system of claim 2 wherein the buckle (150) includes a linear guide (180) and an engagement part (182), the guide and engagement part being associated with the latching or locking of the buckle (150), the engagement part (182) and linear guide (180) are positioned closer to a front of the buckle (150) and the RFID tag (200) is secured to the linear guide (180) and engagement part (182).

4. The system of claim 2 wherein the ejector (156) is positioned closer to the front of the buckle (150) and the RFID tag (200) is secured to the ejector (156).

5. The system of claim 3 wherein the motion of the linearly movable engagement part (182) and linear guide (180) is sensed utilizing the RFID tag (200) and the RFID reader (204).

6. The system of claim 4 wherein the motion of the linearly movable engagement part (182) and linear guide (180) is sensed utilizing the RFID tag (200) and the RFID reader (204).

7. The system of claim 1 wherein the presence or lack thereof of the vehicle seat (100) is sensed, with the seat removed from the vehicle the RFID tag (200) will not generate a signal or generate a rather diminished one.

8. The system of claim 1 wherein when the vehicle seat (100) is folded or slid into a stored position in the vehicle an EM signal from the RFID reader (204) will be reduced in strength and the RFID tag (200) will generate no signal or a reduced signal to the RFID reader (204).

9. The system of claim 1 wherein the RFID tag (200) is passive.

10. The system of claim 3 wherein the linear guide (180) is a cylindrical part that terminates in the engagement part (182) which is situated perpendicular to a central axis of the linear guide (180).

11. The system of claim 9 wherein the passive RFID tag (200) is secured to the top of the engagement part (182) as well as to the top of a thin wall of the linear guide (180), the RFID tag (200) being linearly movable with the engagement part (182) and linear guide (180).

12. The system of claim 1 wherein the EM shield (214) has been placed on the inside of a top portion of a cover of the seat belt buckle (150).

13. The system of claim 1 wherein the EM shield (214) is tin or aluminum foil or isolating plastic or a flexible composite metal and plastic material.

14. The system of claim 13 wherein the unlatched condition of the EM shield (214) totally or partially shields the RFID tag (200) from any incoming radiation indicating the buckle (150) is not latched.

15. The system of claim 14 wherein the RFID tag (200) when displaced away from the EM shield (214) the RFID tag (200) is free to receive incoming radiation from the RFID reader (204) indicating the buckle is latched.

16. The system of claim 1 wherein the RFID reader (204) is in or on a floor or inside a side trim panel.

17. The system of claim 2 wherein the RFID tag (200) has been secured to the ejector (156) and the EM shield (214) is positioned proximate the ejector (156).

18. The system of claim 17 wherein the EM shield (214) totally or partially shields the RFID tag (200) from incoming radiation when the ejector (156) has been withdrawn rearward by insertion of the tongue (120) to the second position apart from the EM shield (214) so it may receive incoming EM radiation.

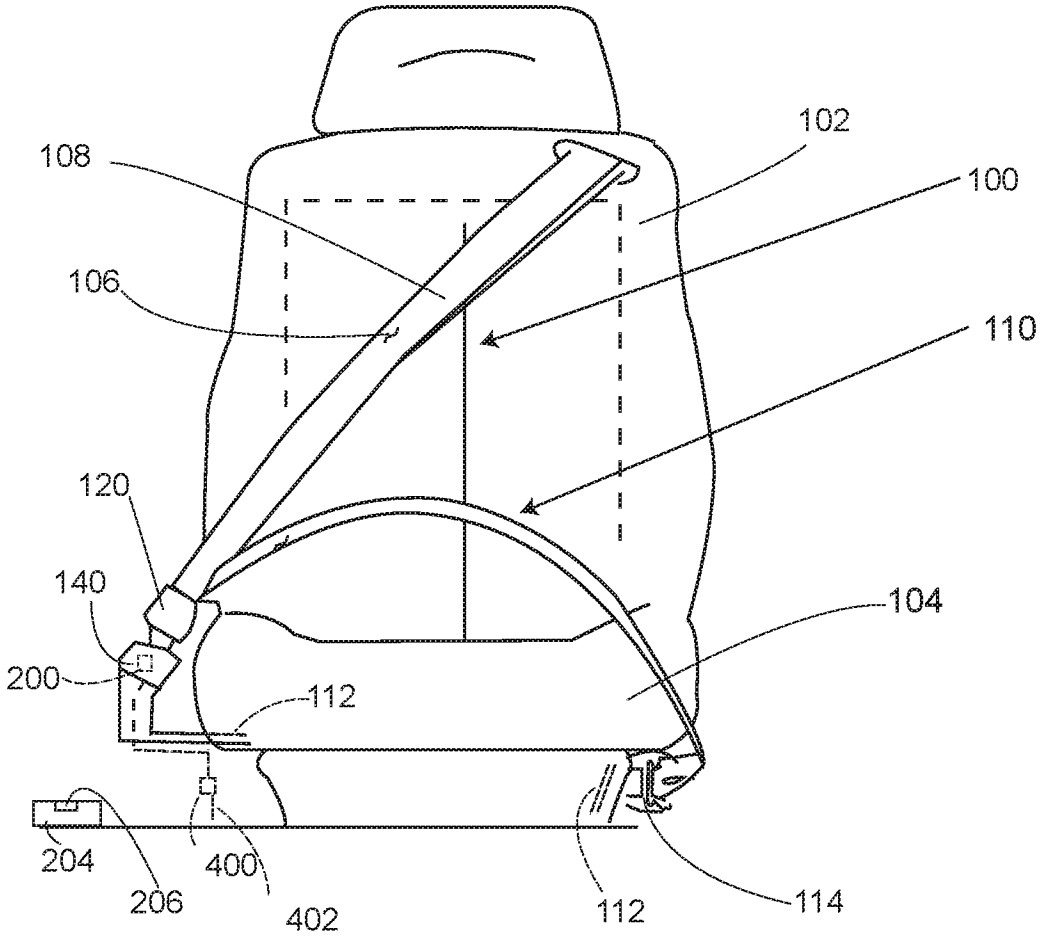


Fig. 1

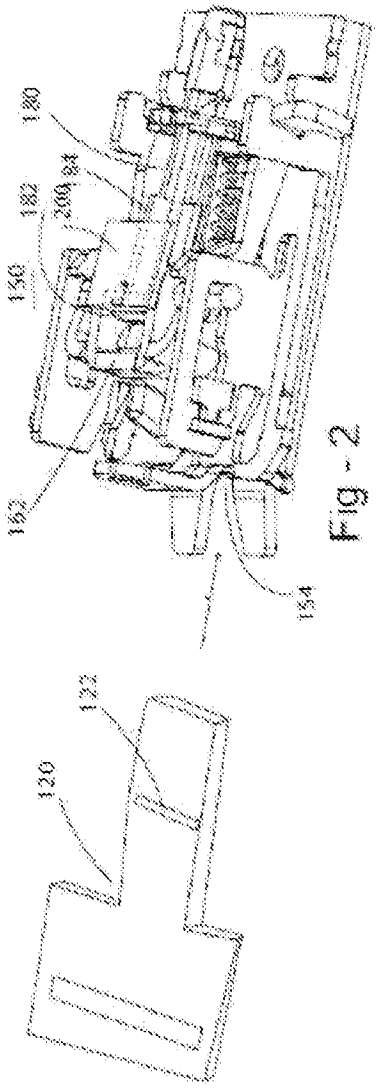


Fig - 2

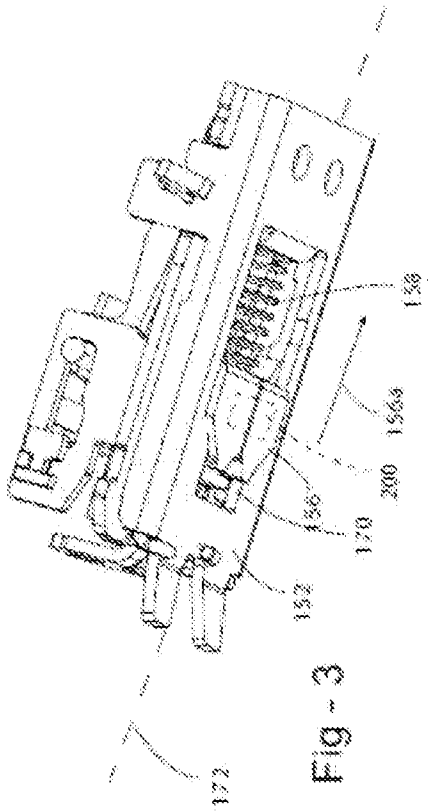


Fig - 3

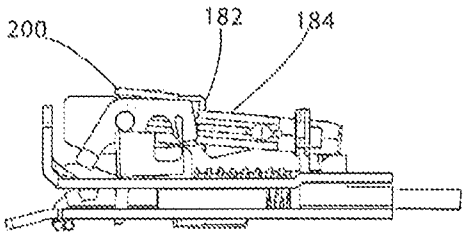


Fig - 5A

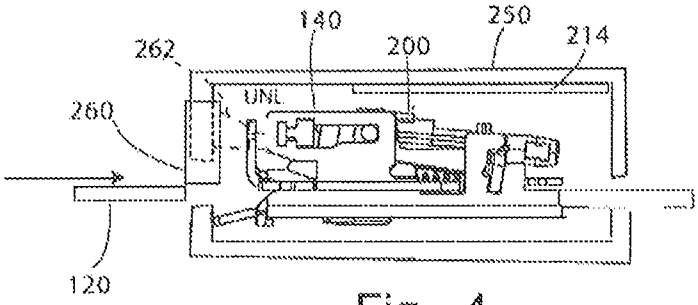


Fig - 4

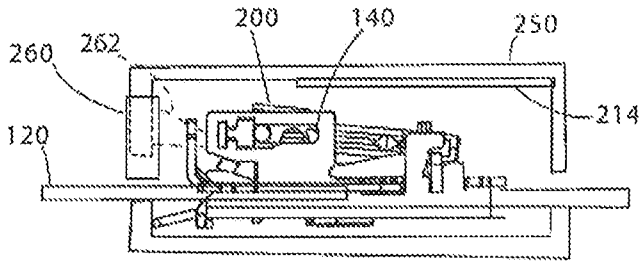


Fig - 5

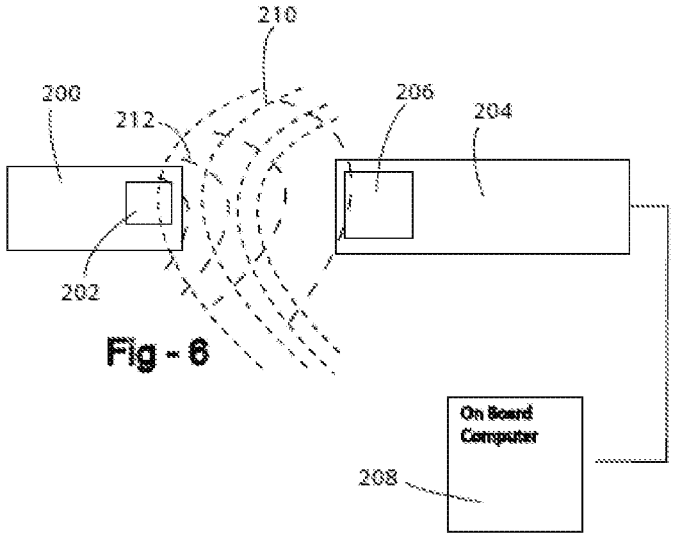

210
200
212
206
204
202
On Board Computer
208

Fig - 6

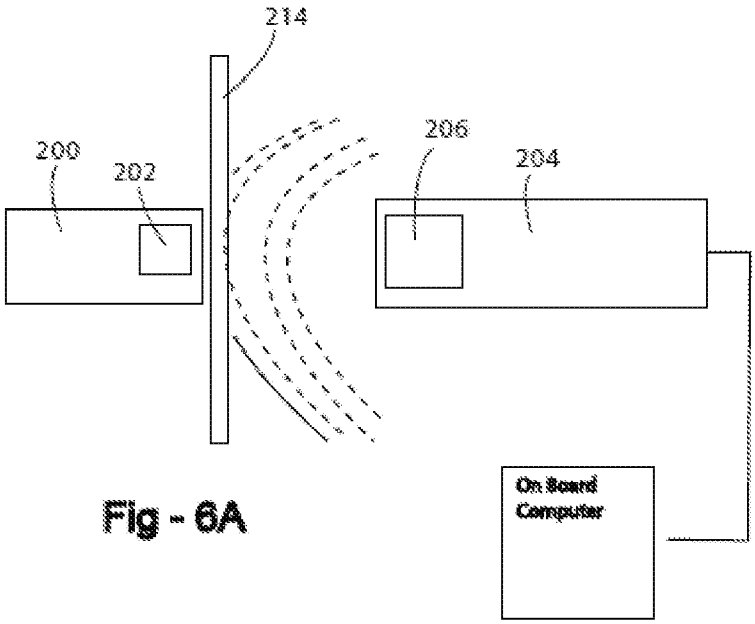
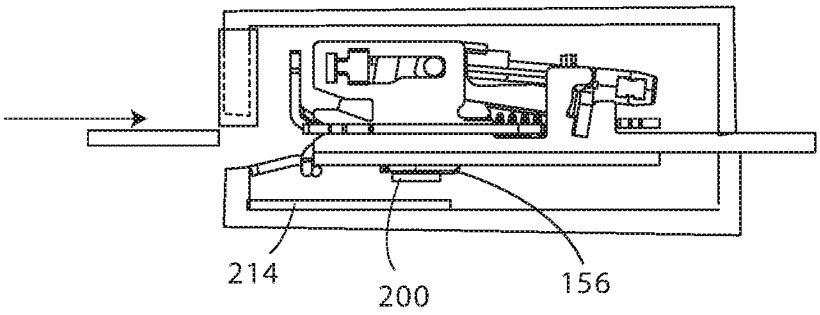

214
206
200
202
204
On Board Computer

Fig - 6A

Fig - 7



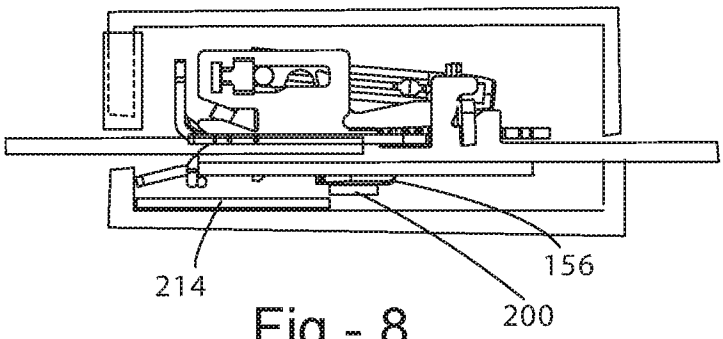


Fig - 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/021523

A. CLASSIFICATION OF SUBJECT MATTER
INV. A44B11/25 B60R22/48
ADD.

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)
A44B B60R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2011/111763 A1 (AUTOLIV DEV [SE]; MIDORIKAWA YUKINORI [JP]) 15 September 2011 (2011-09-15)	1-6,9-18
Y	the whole document	7,8
Y	GB 2 433 384 A (LEAR CORP [US]) 20 June 2007 (2007-06-20) abstract; figures 1,2,3 page 9, line 7 - line 12	7,8
A	US 2009/177357 A1 (LONG DAVID C [US] ET AL) 9 July 2009 (2009-07-09) paragraphs [0022], [0023], [0036]; figures 4A,4B,4C paragraph [0040] - paragraph [0042]	1-18

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* 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	Date of mailing of the international search report
30 May 2016	08/06/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Thielgen, Robert

1

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/021523

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2007/096891 A1 (SHERIFF MICHAEL L [US] ET AL) 3 May 2007 (2007-05-03) abstract; figures 1,2 paragraph [0011] - paragraph [0013] paragraph [0026] -----	1-18

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2016/021523

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2011111763 A1	15-09-2011	JP 2013049290 A	14-03-2013
		WO 2011111763 A1	15-09-2011
GB 2433384 A	20-06-2007	DE 102006055141 A1	21-06-2007
		GB 2433384 A	20-06-2007
		US 2007139185 A1	21-06-2007
US 2009177357 A1	09-07-2009	NONE	
US 2007096891 A1	03-05-2007	NONE	