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(56) Documents Cited:
EP 2620996 A1 **EP 2403049 A2**
WO 2008/153326 A2 **JP 2012084314 A**
JP 2006294336 A **JP 2006286519 A**
JP 2005116342 A **US 20150060164 A1**

(58) Field of Search:
INT CL **H01M**
Other: **Online: WPI, EPODOC**

(54) Title of the Invention: **Battery with at least one housing opening for supplying a cooling medium**
Abstract Title: **Battery with coolant supply chamber having at least one guide element**

(57) A battery comprises a housing (2, fig 5), in which a plurality of single cells are arranged, the housing comprising at least one housing opening (3.3, fig 5) for supplying a cooling medium into the housing. A supply chamber 3 for the cooling medium is provided in the region of the housing opening (3.3, fig 5), in which supply chamber at least one guide element 4 is formed and/or arranged in such a way that at least one outflow path 4.1 for separating and/or penetrating fluid is formed. Preferably, a plurality of guide elements 4 are provided, and are connected to walls 3.5 of the supply chamber 3 in an inclined orientation, in order to provide a meandering path for the coolant. The arrangement prevents any condensation from a moist cooling medium in the supply chamber 3 from reaching the battery housing (2, fig 5).

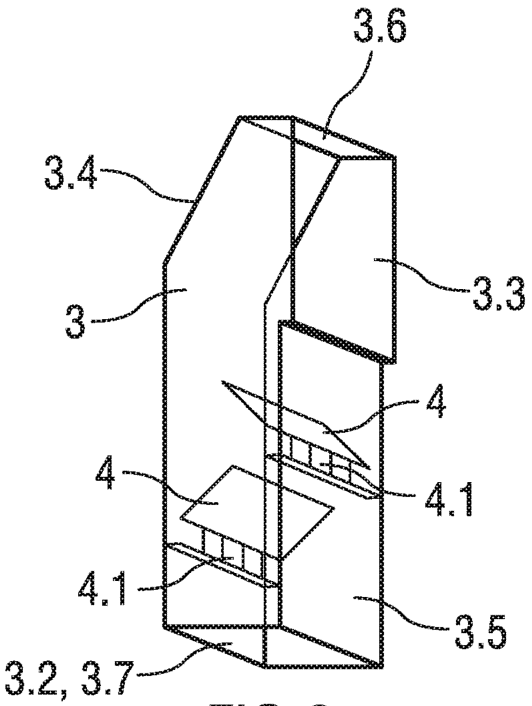

FIG 3

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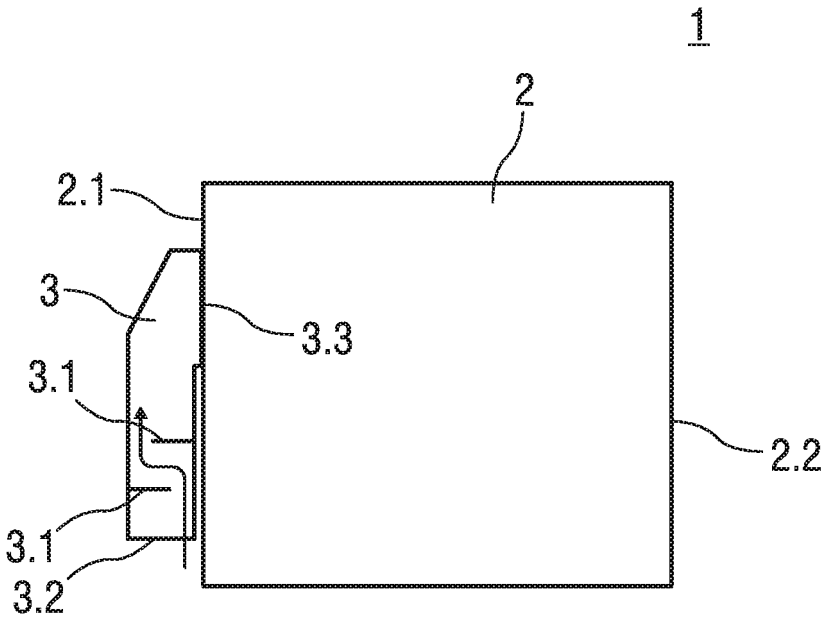

FIG 1
(Prior art)

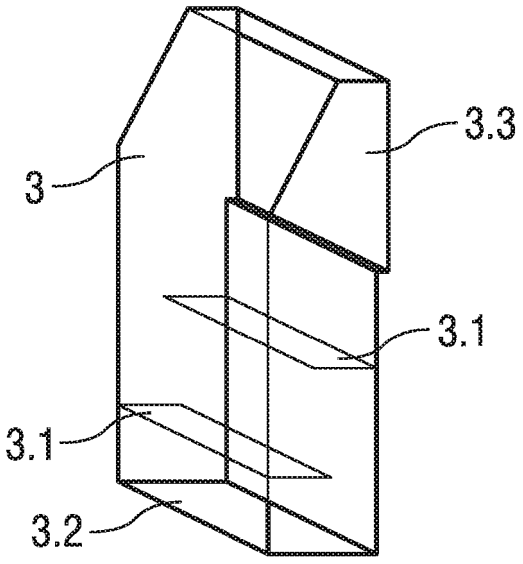

FIG 2
(Prior art)

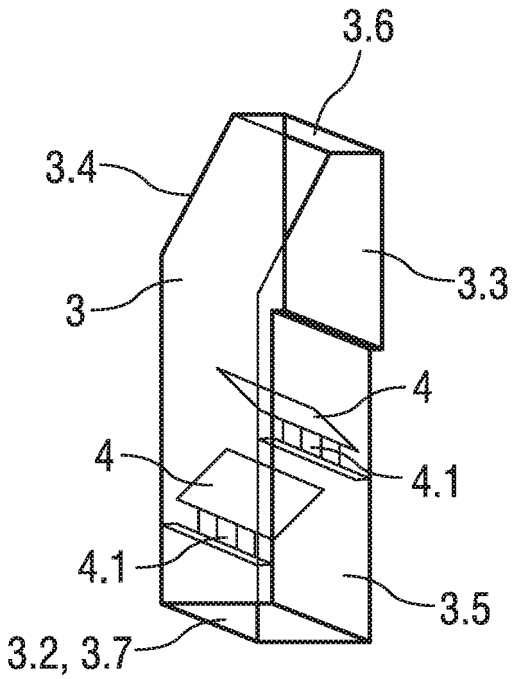

FIG 3

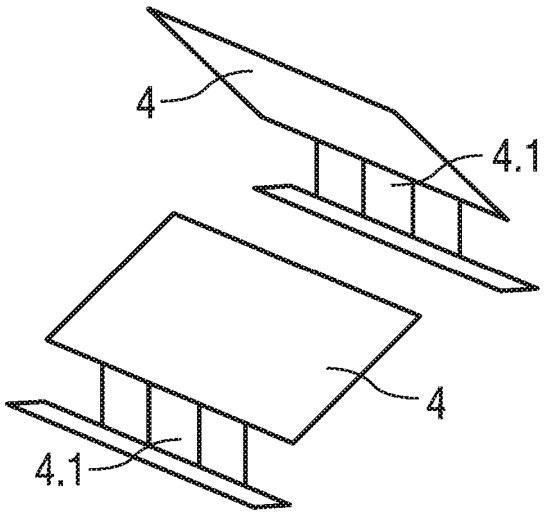

FIG 4

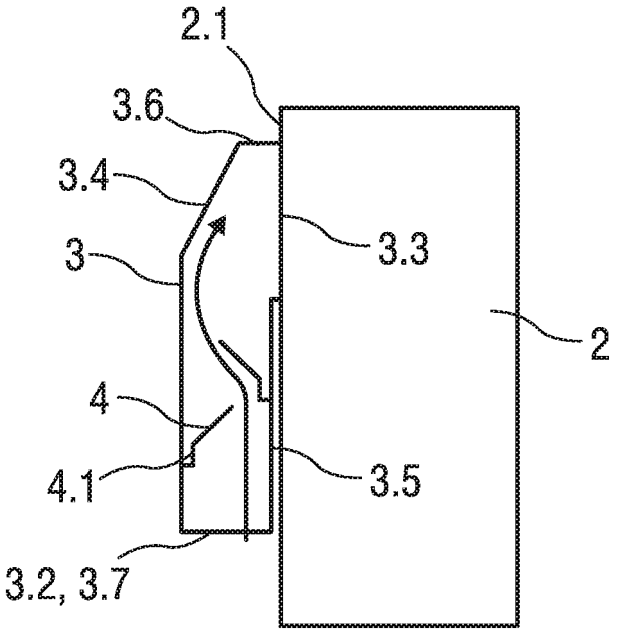

FIG 5

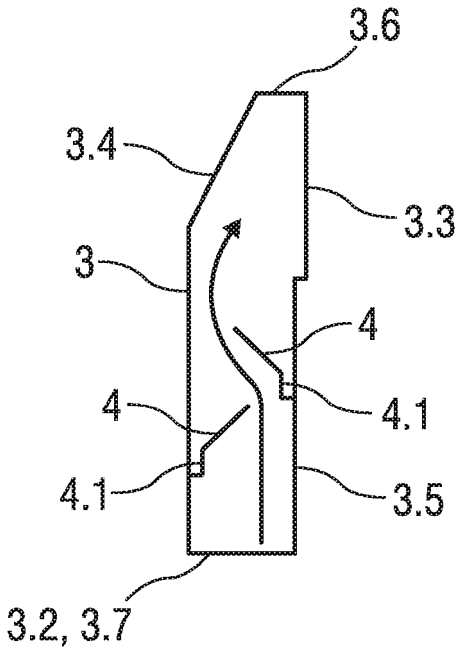

FIG 6

Battery with at least one housing opening for supplying a cooling medium

The invention relates to a battery with a housing, in which single cells are arranged, wherein the housing comprises at least one housing opening for supplying a cooling medium.

A battery for use in motor vehicles, in particular in motor vehicles with a hybrid drive or fuel cell vehicles, usually comprises a cell block composed of a plurality of battery cells electrically connected in series and / or in parallel, for example lithium-ion cells.

The single cells must be cooled in order to remove the heat dissipation produced. In this connection liquid cooling or cooling by means of pre-cooled air which is conveyed between the single cells is generally used.

US20090191452 discloses a battery comprising a composite cell composed of a plurality of single cells and having a temperature distribution over the whole composite cell and an air flow through such a battery, the cell temperature and the temperature difference between the single cells in the composite cell ensuring heat management and associated safety, power and lifespan of the battery or an electrochemical cell. A battery is also disclosed having a flow through the composite cell in order to avoid a pressure loss in the battery.

WO08120056 discloses an energy storage device, comprising an energy storage unit and a first container in which the energy storage unit is contained, wherein a gas is discharged from the energy storage unit into the first container if a deviation with the production of a gas arises in an electrical storage unit. The energy storage unit is characterised in that a first discharge channel is used for discharging the gas in the first container from the vehicle and a second discharge channel is provided for discharging the gas in the first container into a second container.

It is an object of the invention to indicate improved cooling of a battery with a housing in comparison with the prior art.

The object is achieved according to the invention in relation to the cooling of the battery with a housing through the features indicated in claim 1.

Advantageous embodiments of the invention are the subject matter of the sub-claims.

A battery comprises a housing, in which a plurality of single cells are arranged, wherein the housing comprises at least one housing opening for supplying a cooling medium into the housing. A supply chamber for the cooling medium is provided in the region of the housing opening, in which supply chamber at least one guide element is formed and / or arranged in such a way that at least one outflow path for a separating and / or penetrating fluid, in particular condensed and / or penetrated water, is formed.

During operation of such a battery there is usually a heat dissipation which should be removed. The heat dissipation can lead to overheating of the battery and the single cells arranged in the battery. Damage, in particular deformations, and / or possible destruction of the single cells of the battery, arise as a consequence of this overheating.

In order to protect the single cells, in particular round or flat cells, from such overheating and resulting damage, the cooling medium is introduced into the battery.

The cooling medium, in particular air and / or pre-cooled air, is supplied through a housing opening provided for this purpose to the housing of the battery. The housing is connected to the supply chamber of the cooling medium through at least one flow connection.

According to a possible embodiment, at least one guide element is formed and / or arranged in the supply chamber.

At least one flow path for the cooling medium in the direction of the housing opening is formed through a preferred arrangement and / or formation of the guide element.

According to a further embodiment at least one guide element is preferably formed and / or arranged at an inflow opening of the supply chamber. Such an inflow opening serves for introducing the cooling medium into the supply chamber provided for this purpose.

Through this arrangement and / or formation of the at least one guide element at the inflow opening of the supply chamber, the cooling medium introduced is conveyed directly in the direction of the housing opening through the supply chamber.

A possible embodiment of the invention provides that the guide element is formed in such a way that an outflow path for the fluid is formed. According to an exemplary embodiment the guide element arranged in the supply chamber is provided with at least one passage opening which forms the outflow path. Through this further function of the at least one guide element arranged in the supply chamber, an inflow of a greater amount of liquid, in particular water, is extensively prevented. The invention is suited in particular for removing a water stream flowing into the supply chamber again, for example during cleaning of the motor vehicle at a washing installation. Damage resulting from it, in particular destruction of the single cells, is thus clearly reduced or even avoided.

In case of inflow of a moist cooling medium into the supply chamber, condensation can arise. In such a case, condensed water reaches the guide element. This separating water is advantageously removed through a corresponding form and / or arrangement of the guide element, for example through the passage opening thereof, and thus serves as an outflow path.

A plurality of guide elements are preferably arranged in the supply chamber one on top of the other and / or one beside the other in the flow direction, each guide element comprising at least one passage opening.

According to an advantageous embodiment these guide elements arranged in the supply chamber one on top of the other are formed and / or arranged in such a way that a meandering flow path is produced. The guiding surfaces of the guide elements are inclined in relation to the flow direction by a predefined angle, in particular in the range of from 20° to 60°. Through this meandering progression of the cooling medium in the direction of the housing opening, the flow path in the supply chamber is improved.

Exemplary embodiments of the invention are explained in greater detail below by reference to the drawing, in which:

Fig. 1 shows, schematically, a side view of a battery with a supply chamber according to the prior art,

Fig. 2 shows, schematically, a perspective view of the supply chamber for a cooling medium for a battery according to the prior art,

Fig. 3 shows, schematically, a perspective view of a supply chamber for a cooling medium according to the invention,

Fig. 4 shows, schematically, an enlarged illustration of a perspective view of a guide element,

Fig. 5 shows, schematically, a side view of the supply chamber shown in Fig. 4 on a housing of the battery and

Fig. 6 shows, schematically, a side view of the supply chamber for a liquid medium shown in Figs. 4 and 5.

Components corresponding to each other are provided with the same reference numerals in all the drawings.

Fig. 1 represents a battery 1 with a supply chamber 3 according to the prior art.

The battery 1 comprises the housing 2, in which a plurality of single cells (not shown in greater detail) connected to each other in parallel and / or in series are arranged. These single cells are electrically connected to each other at terminals (not shown in further detail) in dependence upon a desired operating voltage and power and form a composite cell.

The housing 2 comprises a housing side wall 2.1 which comprises a housing opening (not shown) and further housing side walls 2.2.

A supply chamber 3 for introducing a cooling medium is arranged on the housing side wall 2.1. The cooling medium flows into the housing 2 of the battery 1 through the housing opening on the housing side wall 2.1. The housing opening is connected to an outflow opening 3.3 of the supply chamber 3.

A plurality of guide plates 3.1 are formed in the supply chamber 3. These guide plates 3.1 are arranged parallel to each other and offset relative to a supply chamber bottom 3.2. The cooling medium is conveyed into the supply chamber 3 through the supply chamber bottom 3.2 with an inflow opening 3.7.

Through the arrangement of a plurality of guide plates 3.1 offset parallel to each other, a high resistance is produced, through which the pressure of the cooling medium is reduced. The cooling air flow, illustrated here as an arrow, flows against the guide plate 3.1 and is deflected along the guide plate 3.1 in the form of a sharp curve. The cooling medium is slowed down through this deflection and a pressure loss takes place.

The battery cooling takes place in a slowed down and weakened manner, as the pressure of the cooling air flow reduces further following entry into the housing 2, caused by the previous pressure loss.

In order to maintain the pressure, the cooling medium is permanently supplied with an increased pressure to the inflow opening. This permanent supply of the cooling medium by means of a blower (not shown), in particular a cooling air blower, leads to a greatly increased power consumption.

This arrangement of the guide plates 3.1 also appears disadvantageous to the hygiene and lifespan of the supply chamber 3. Due to the horizontal position of the guide plates 3.1, dust can be deposited and water can collect whereby corrosion in the supply chamber 3 and on the guide plates 3.1 can result from the collection of water.

Fig. 2 shows the supply chamber 3 with two guide plates 3.1 according to the prior art.

The supply chamber 3 comprises essentially a broad, square form.

Through the increased supply of the cooling medium through the blower (not shown), it is possible to compensate for the pressure loss mentioned in Fig. 1. A broad, square form of the supply chamber 3 can support such a supply but disadvantageously leads to an increased power consumption and thus associated costs.

In order to compensate for the abovementioned disadvantages of the supply chamber 3 according to the prior art, according to the invention a supply chamber 3 shown in Fig. 3 is formed with at least one guide element 4 for a cooling medium.

The supply chamber 3 comprises two guide elements 4, an inflow opening 3.7 and an outflow opening 3.3, forming at least one flow connection to a housing 2 (not shown here in greater detail) of a battery.

The supply chamber 3 has substantially a square form as far as a lower edge of the outflow opening 3.3. An opposite side wall 3.4 is angled in the region of this

outflow opening 3.3 which is square. A supply chamber ceiling 3.6 connects the angled side wall 3.4 to the upper edge of the outflow opening 3.3.

The guide element 4 hereby comprises at least one passage opening 4.1. Such a passage opening 4.1 is formed at an end of the guide element 4, the end comprising a connection to the angled side wall 3.4 and / or to a further side wall 3.5 of the supply chamber 3.

Through a preferred arrangement and / or formation of at least one guide element 4 with at least one passage opening 4.1 in the supply chamber 3, at least one outflow path for a separating and / or penetrating fluid, in particular condensed and / or penetrated water, is formed.

In order to prevent an inflow of an increased amount of the fluid and associated damage to the battery 1, at least one guide element 4 is formed and / or arranged at the inflow opening 3.7 according to a preferred embodiment. Such a fluid can flow into the supply chamber 3, for example during cleaning at a washing installation of a motor vehicle, whereby a water jet is sprayed with high pressure against the under-body of the motor vehicle.

The water which is not prevented from penetrating by the guide elements 4 flows with the cooling medium in the direction of the outflow opening 3.3. This water settles on the supply chamber ceiling 3.6 and flows back through at least one passage opening 4.1 of a guide element 4 provided for it. Such a removal of the water prevents the collection in the supply chamber 3 and resulting corrosion.

According to an alternative embodiment, a supply chamber bottom 3.2 is provided which comprises an inflow opening 3.7 as a recess, the supply chamber bottom 3.2 being inclined towards the inflow opening 3.7. The water can be removed more quickly through this inclination.

According to a possible embodiment, at least one guide element 4 is formed and / or arranged in the supply chamber 3 in such a way that at least one flow path is formed for the cooling medium in the direction of the outflow opening 3.3. The

outflow opening 3.3 is connected to the housing opening of the battery housing 2 which is not shown in greater detail.

According to a further embodiment the number of guide elements 4 varies, each guide element 4 comprising at least one of these passage openings 4.1. The guide elements 4 are thereby arranged one on top of the other and / or one beside the other in the supply chamber 3 and form the flow and outflow path.

The resistance is reduced through an advantageous embodiment of the guide elements 4, wherein the guiding surfaces of the guide elements are arranged inclined relative to the flow path, in particular at a predefined angle in the range of from 20° to 60°. This inclination conveys the co oling medium in a meandering manner and by means of the angled side wall 3.4 of the supply chamber 3 in the direction of the outflow opening 3.3.

The pressure of the cooling medium after the meandering conveyance thereof remains virtually unchanged both in the supply chamber 3 and after the outflow opening 3.3 in the housing 2 of the battery 1. Through such a conveyance, the cooling medium can flow quickly and extensively friction-free into the housing 2 (not shown) and remove the heat dissipation of the single cells. Such a rapid heat removal protects against overheating and extends the lifespan of the battery 1.

The supply with a low pressure is advantageously sufficient in order to achieve the rapid cooling of the battery 1 (not shown), so that the output and the power consumption of the blower, in particular cooling air blower, which can be arranged at the inflow opening 3.7, remain low. In order to support such a supply in a cost-saving way, a compact square form of the supply chamber 3 can be formed.

Assembly resources and material consumption for the production of the supply chamber 3, reduced in size in comparison with the prior art, with the guide elements 4 remain low and are thus cost-saving. A further advantage is the

reduced weight and the reduced construction space requirement of such a supply chamber 3.

The prevention of larger dust deposits is achieved through the inclined position of the guide elements 4 and the supply chamber bottom 3.2. The at least one passage opening 4.1 is advantageously formed in such a way on the guide element 4 that the cleaning can be carried out easily and without complication.

Fig. 4 shows an enlarged illustration of the guide elements 4 with passage openings 4.1.

The guide elements 4 comprise at least one passage opening 4.1.

According to a possible embodiment, each guide element 4 comprises a plurality of passage openings 4.1, which simplifies the removal of the water.

Figs. 5 and 6 show the supply chamber 3 with guide elements 4, whereby Fig. 5 shows the flow path for the cooling medium and Fig. 6 shows the outflow path for the separating and / or penetrating fluid.

The supply chamber 3 comprises the angled side wall 3.4, the inflow opening 3.7 on the supply chamber bottom 3.2 and the outflow opening 3.3, which forms at least one flow connection to the housing 2 of the battery 1.

The flow path for the cooling medium, shown as an arrow in Fig. 5, extends in a meandering manner through the supply chamber 3. By inclining the at least one guide element 4 and the side wall 3.4, the pressure can be maintained, as the conveyance takes place virtually friction-free.

The outflow path for the fluid, shown in Fig. 6 as an arrow, extends without risk to the battery 1 through the supply chamber 3, the inflow of the water into the housing 2 of the battery 1, shown in Fig. 5, being prevented.

Reference numerals

1	Battery
2	Housing
2.1	Housing side wall
2.2	Further housing side wall
3	Supply chamber
3.1	Guide plate
3.2	Supply chamber bottom
3.3	Outflow opening
3.4	Angled side wall
3.5	Further side wall
3.6	Supply chamber ceiling
3.7	Inflow opening
4	Guide element
4.1	Passage opening

Claims

1. Battery with a housing (2), in which single cells are arranged, and with at least one housing opening for supplying a cooling medium into the housing (2),
characterised in that a supply chamber (3) for the cooling medium is provided in the region of the housing opening, in which supply chamber (3) at least one guide element (4) is formed and / or arranged in such a way that at least one outflow path for a separating and / or penetrating fluid is formed.

2. Battery according to claim 1,
characterised in that at least one flow connection is formed between the supply chamber (3) and the housing (2).

3. Battery according to claim 1 or 2,
characterised in that the at least one guide element (4) is formed and / or arranged in such a way that at least one flow path for the cooling medium in the direction of the housing opening is formed.

4. Battery according to one of the preceding claims,
characterised in that at least one guide element (4) is formed at an inflow opening (3.7) of the supply chamber (3).

5. Battery according to one of the preceding claims,
characterised in that the guide element (4) comprises at least one passage opening (4.1) which forms the outflow path.

6. Battery according to one of the preceding claims,
characterised in that
a plurality of guide elements (4) are arranged in the flow direction in the supply chamber (3) one on top of the other and / or one beside the other.

7. Battery according to one of the preceding claims,
characterised in that the guide element (4) or the guide elements (4) is / are formed and / or arranged in such a way in the supply chamber (3) that the flow

path for the cooling medium extends in a meandering manner, guiding surfaces of the guide element (4) or the guide elements (4) being inclined (at a predefined angle in the range of from 20° to 60°, in particula r 30° to 45°) relative to the flow path.

Intellectual Property Office

Application No:	GB1601388.0	**Examiner:**	Dr Steven Chadwell
Claims searched:	1-17	**Date of search:**	6 October 2016

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-7	US 2015/0060164 A1 (WANG et al) see figures 2-4 and paragraphs [0024]-[0035] in particular
X	1-7	JP 2005116342 A (TOYOTA) see the figures and also the EPODOC abstract and WPI Abstract Accession No. 2005-301234
X	1-6	WO 2008/153326 A2 (LG) see whole document, especially figures 3-7
X	1-6	JP 2012084314 A (HINO) see figures 1-5 in particular, and also the EPODOC abstract and WPI Abstract Accession No. 2012-E77876
X	1-6	JP 2006294336 A (TOYOTA) see figure 7 and paragraphs [0038]-[0041] in particular, and also the EPODOC abstract and WPI Abstract Accession No. 2006-806076
X	1-6	JP 2006286519 A (TOYOTA) see figure 11 and paragraphs [0038]-[0039] in particular, and also the EPODOC abstract and WPI Abstract Accession No. 2006-786308
X	1-5	EP 2620996 A1 (SAMSUNG) see figures 4-7, and paragraphs [0042]-[0058] in particular
X	1-5	EP 2403049 A2 (LG) see figure 18 and paragraph [0112] in particular

Categories:

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

Intellectual Property Office

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[X] :

Worldwide search of patent documents classified in the following areas of the IPC

H01M

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC

International Classification:

Subclass	Subgroup	Valid From
H01M	0010/6561	01/01/2014
H01M	0010/613	01/01/2014
H01M	0010/625	01/01/2014
H01M	0010/6566	01/01/2014