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(54) Title: IGNITER

(57) Abstract: An igniter for an igniter system for an airbag inflation system is disclosed. The igniter includes a hermetically sealable chamber, an opening, a dome shaped frangible wall, a port and a mounting flange. The hermetically sealable chamber is adapted to hold a propellant gas under pressure. The opening is for securing an igniter trigger. The dome shaped frangible wall of pre-determined thickness is adapted to break at a gas pressure of at least 90 bar. The port is adapted for filling propellant gas under pressure inside said chamber. The mounting flange is adapted for mounting the igniter within an airbag inflating unit.



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IGNITER

FIELD OF THE INVENTION

The present invention relates to safety devices for vehicles. Particularly, the present invention relates to an igniter for an igniter system for an airbag inflation system for vehicles.

BACKGROUND OF THE INVENTION

Safety devices, such as airbags and seat belts are used in vehicles for protection of passengers. Airbags are used in vehicles as supplementary restraint systems to protect passengers in case of high speed collision. To reduce the risk of collision it has been known to mount an inflatable restraint on the hub of the steering wheel or on the instrument panel in the passenger compartment to supplement seat belts in the event of a frontal crash. Inflators form a part of the system and help in producing and injecting gas into the airbag at the required pressure and mass flow rate. There are several types of inflators: one type of inflator includes a pyrotechnic material that explodes to produce the required gas for inflation; another type of inflator involves using stored high pressure gas to inflate the airbag.

Igniter used in the airbags is adapted for igniting gaseous mixture used in the airbags. Although, the conventional igniters are useful for igniting gaseous mixture used in the airbags, the conventional igniters have numerous limitations. For example, the conventional igniters are costly. Further, the conventional igniters have comparatively low reaction rate. Furthermore, the

conventional igniters have complicated structure and complex manufacturing process.

For example, US patent US 5,772,243 having priority date Dec. 4, 1995 discloses a low pressure igniter system for a gas bag inflator using a head-end chamber or closure to house a pyrotechnic ignition compound that is ignited by an initiator (squib). The housing for the igniter includes a base having a skirt that extends from the periphery of the base with the base and the skirt being a single piece of material. When initiated the low pressure igniter has a large flame front producing hot gas and particles. However, the low pressure igniter of US 5,772,243 has comparatively complex structure.

US patent US 6,166,452 having priority date January 20, 1999 discloses an igniter for igniting a reactive material has a conductor for conducting power and communication signals to and from the igniter. A controller is located within the igniter. The controller is preferably an application specific integrated circuit (ASIC). The controller has communication means for communicating with a master controller located remote from the igniter. The controller also has diagnostic means for comparing established parameters for components of the igniter to predetermined limits and sending fault warning messages and integrity status messages to the master control unit. However, the igniter of US 6,166,452 has comparatively complicated structure and high cost.

US publication US20050132919 having priority date Dec 17, 2003 discloses a squib. The squib includes a heat-generating portion that has an energizing portion and a fuel portion, and that is formed such that heat that is generated

by supplying current to the energizing portion can be transmitted to the fuel portion to ignite the same. The squib includes a noise removal device that is connected in parallel with the heat generating portion, and a circuit element that temporally scatters noise such that the noise is more completely removed by the noise removal device. However, the squib of US20050132919 publication has comparatively low reaction rate.

Accordingly, there is a need for an igniter for an igniter system that is comparatively inexpensive. Further, there is a need for an igniter that has comparatively high reaction rate. Also, there is a need for an igniter that has simple structure.

OBJECTS OF THE INVENTION

An object of the present invention is to provide an igniter for an igniter system that is comparatively inexpensive.

Another object of the present invention is to provide an igniter that is adapted to provide variable igniter response time as per the requirement of the user.

Yet another object of the present invention is to provide an igniter that has a simple structure.

Still another object of the present invention is to provide an igniter that is adapted to generate different amount of heat to ignite reactive mixture using different mole fractions.

One more object of the present invention is to provide an igniter that has comparatively high reaction rate.

Also, an object of the present invention is to provide an igniter that is adapted to respond only to a specific command signal from an Engine Control Unit (ECU) for facilitating a fool proof triggering circuit.

Additionally, an object of the present invention is to provide an igniter that is easy to manufacture.

Further, an object of the present invention is to provide an igniter that has modular structure.

SUMMARY OF THE INVENTION

In accordance with one aspect of the present invention there is provided an igniter for an igniter system for an airbag inflation system. The igniter includes a hermetically sealable chamber, an opening, a dome shaped frangible wall, a port and a mounting flange. The hermetically sealable chamber is adapted to hold a propellant gas under pressure. The opening is for securing an igniter trigger. The dome shaped frangible wall of predetermined thickness is adapted to break at a gas pressure of at least 90 bar. The port is adapted for filling propellant gas under pressure inside said chamber. The mounting flange is adapted for mounting the igniter within an airbag inflating unit.

In one embodiment of the present invention, the igniter trigger consists of at least one pair of electrodes adapted to generate an arc there-between,

insulators adapted to isolate the electrodes and an electric circuit adapted to generate a high voltage arc between the electrodes.

Typically, the electrodes are of stainless steel.

Typically, the electrodes are of tungsten.

Preferably, the insulators are of ceramic.

Furthermore, the insulators are cylindrical shaped.

Additionally, in one embodiment of the present invention the dome shaped frangible wall is hemispherical in shape.

The dome shaped frangible wall may be of stainless steel.

Alternatively, the dome shaped frangible wall is of aluminum.

Preferably, the port is a micro filling port that can be sealed.

In one embodiment of the present invention, the electrodes are vacuum brazed to the insulators.

Typically, the insulators are connected to the mounting flange by brazing.

The electrode may be separated by a distance in the range of 0.3mm to 1 mm with respect to each other.

Typically, the electric circuit generates voltage in the range of 5 KV to 20 KV.

Typically, the electric circuit generates an arc of energy up to 2 milli Joule

BRIEF DESCRIPTION OF ACCOMPANYING DRAWINGS

The invention will now be described in relation to the accompanying drawings in which,

Figure 1 illustrates an exploded view of an igniter for an igniter system, in accordance with one embodiment of the present invention;

Figures 2 illustrates a top view of the igniter of figure 1;

Figure 3 illustrates a sectional view of the igniter of figure 1;

Figure 4 illustrates a sectional view of the igniter of figure 1 coupled to an airbag inflator; and

Figure 5 illustrates an igniter trigger circuit of the igniter of figure 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Preferred embodiments will now be described in detail with reference to the accompanying drawings. The preferred embodiments do not limit the scope

and ambit of the invention. The description provided is purely by way of example and illustration.

The present invention envisages a low cost fluid propellant based igniter for igniting reactive mixture and specifically to provide different reaction rates by using different mole fractions of gas mixtures to achieve desired heat generation and response time, along with an intelligent closed loop triggering circuit in communication with the master control unit to prevent false triggering of the igniter.

Referring to Figure 1 to Figure 3, an igniter 100 for an igniter system for an airbag inflation system is illustrated. The igniter includes a hermetically sealable chamber 102, an opening, a dome shaped frangible wall 104, a port 106 and a mounting flange 108.

The hermetically sealable chamber 102 is adapted to hold a propellant gas under pressure. The size of the hermetically sealable chamber 102 may be varied to suit specific application. The igniter trigger is secured in the opening. The igniter trigger consists of at least one pair of electrodes 110 adapted to generate an arc there-between, insulators 112 adapted to isolate the electrodes 110 and an electric circuit 114 adapted to generate a high voltage arc between the electrodes 110. The electrodes 110 may be vacuum brazed to the insulators 112. However, the electrodes may also be coupled to the insulators 112 by any other means and mechanisms known in the art. The electrode may be separated by a distance in the range of 0.3 mm to 1 mm with respect to each other. In one embodiment of the present invention, the pair electrodes 110 is of stainless steel. In yet another embodiment of the

present invention, the pair of electrodes 110 is of tungsten. However, the present invention is not limited to any particular material used for manufacturing the pair of electrodes 110.

The insulators 112 may be brazed to a bottom flange 116. However, the present invention is not limited to any particular mechanism used for joining the insulators 112 to the bottom flange 116. The insulators 112 are adapted to isolate the electrodes 110 and the body of the igniter 100. Further, in one embodiment of the present invention, the insulators 112 are of ceramic. However, the present invention is not limited to any particular material used for manufacturing the insulators 112. Furthermore, in one embodiment of the present invention, the insulators are cylindrical shaped. However, the present invention is not limited to any particular shape of the insulators 112. In one embodiment of the present invention, the insulators 112 are adapted to withstand high thermal shock (upto 3000 ° K), pressure shocks (> 150 bar), and provide electric insulation to electrodes upto 20 KV (isolate the electrode from the steel body and prevent stray arcing).

In one embodiment of the present invention, the electric circuit 114 is adapted to generate a voltage in the range of 5 KV to 20 KV. However, the electric circuit 114 of the present invention is not limited to any particular voltage range. Further, in another embodiment of the present invention, the electric circuit 114 is adapted to generate an arc of energy up to 2 milli Joule. However, the electric circuit 114 of the present invention is not limited to any particular limit of energy generated.

The dome shaped frangible wall 104 of pre-determined thickness is adapted to break at a gas pressure of at least 90 bar. In one embodiment of the present invention the dome shaped frangible wall 104 is hemispherical in shape. However, the present invention is not limited to any particular shape of the dome shaped frangible wall 104. Further, in another embodiment of the present invention, the dome shaped frangible wall 104 is of aluminum. However, the present invention is not limited to any particular material used for manufacturing the dome shaped frangible wall 104.

The port 106 is adapted for filling propellant gas under pressure inside said chamber. In one embodiment of the present invention, the port 106 is a micro filling port that can be sealed. In use, a pre-defined concentration of gas mixture is filled into to the igniter chamber through the port 106. The port 106 is adapted to function both as filling and gas sealing port. The gas mixtures (mole fractions) are selected based on the end application and desired final response time or amount of heat to be generated. The mounting flange 108 is adapted for mounting the igniter 100 within an airbag inflating unit.

The igniter 100 of the present invention is adapted to provide a specific igniter response time to suit a particular application as per the requirement of the user. The above mentioned invention can cater to different igniter response time, amount of heat generated (applications) by simply changing the mole fraction of the gas propellant mixture filled in the igniter and the triggering time. In one embodiment of the present invention, the gas propellant mixture includes hydrogen gas, nitrogen gas and an inert gas. Accordingly, the igniter 100 of the present invention is simple in

construction, modular and low cost design. In one embodiment of the present invention, the igniter 100 of the present invention is adapted to provide igniter response time of <1 milli second.

TECHNICAL ADVANCEMENTS AND ECONOMIC SIGNIFICANCE

The igniter for an igniter system for an airbag inflation system of the present invention is comparatively inexpensive. Further, the igniter of the present invention is adapted to provide variable igniter response time as per the requirement of the user. Furthermore, the igniter has a simple structure. Moreover, the igniter of the present invention is adapted to generate different amount of heat to ignite reactive mixture using different mole fractions. Also, the igniter has comparatively high reaction rate. Additionally, the igniter is adapted to respond only to a specific command signal from an Engine Control Unit (ECU) for facilitating a fool proof triggering circuit. Further, the igniter is easy to manufacture. Furthermore, the igniter has a modular structure.

The numeral values given of various physical parameters, dimensions and quantities are only approximate values and it is envisaged that values higher or lower than the numerical value assigned to the physical parameters, dimensions and quantities fall within the scope of the invention and the claims unless there is a statement in the specification to the contrary.

While considerable emphasis has been placed herein on the components and component parts of the preferred embodiments, it will be appreciated that many embodiments can be made and that many changes can be made in the preferred

embodiments without departing from the principles of the invention. These and other changes in the preferred embodiment as well as other embodiments of the invention will be apparent to those skilled in the art from the disclosure herein, whereby it is to be distinctly understood that the foregoing descriptive matter is to be interpreted merely as illustrative of the invention and not as a limitation.

Claims:

1. An igniter for an igniter system for an airbag inflation system, the igniter comprising:
 - a hermetically sealable chamber adapted to hold a propellant gas under pressure;
 - an opening for securing an igniter trigger;
 - a dome shaped frangible wall of pre-determined thickness adapted to break at a gas pressure of at least 90 bar;
 - a port for filling propellant gas under pressure inside said chamber; and
 - a mounting flange for mounting said igniter within an airbag inflating unit.
2. The igniter as claimed in claim 1, wherein said igniter trigger consists of at least one pair of electrodes adapted to generate an arc there-between, insulators adapted to isolate the electrodes and an electric circuit adapted to generate a high voltage arc between the electrodes.
3. The igniter as claimed in claim 1, wherein said electrodes are of stainless steel.
4. The igniter as claimed in claim 1, wherein said electrodes are of tungsten.

5. The igniter as claimed in claim 1, wherein said insulators are of ceramic.
6. The igniter as claimed in claim 1, wherein said insulators are cylindrical shaped.
7. The igniter as claimed in claim 1, wherein said dome shaped frangible wall is hemispherical in shape.
8. The igniter as claimed in claim 1, wherein said dome shaped frangible wall is of stainless steel.
9. The igniter as claimed in claim 1, wherein said dome shaped frangible wall is of aluminum.
10. The igniter as claimed in claim 1, wherein said port is a micro filling port that can be sealed.
11. The igniter as claimed in claim 1, wherein said electrodes are vacuum brazed to said insulators.
12. The igniter as claimed in claim 1, wherein said insulators are connected to said mounting flange by brazing.
13. The igniter as claimed in claim 1, wherein said electrode are separated by a distance in the range of 0.3 mm to 1 mm with respect to each other.

14. The igniter as claimed in claim 1, wherein said electric circuit generates voltage in the range of 5 KV to 20 KV.
15. The igniter as claimed in claim 1, wherein said electric circuit generates an arc of energy up to 2 milli Joule.

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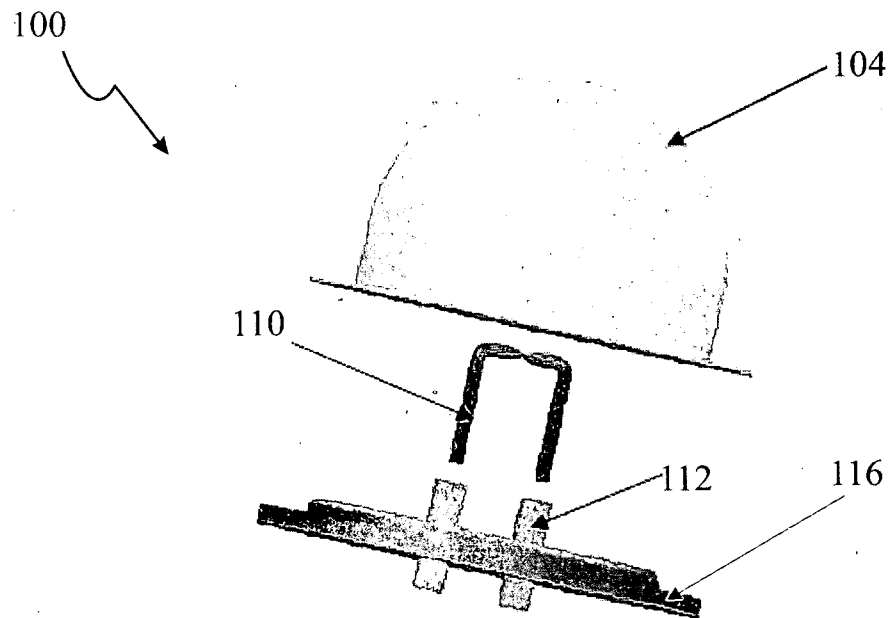


FIGURE - 1

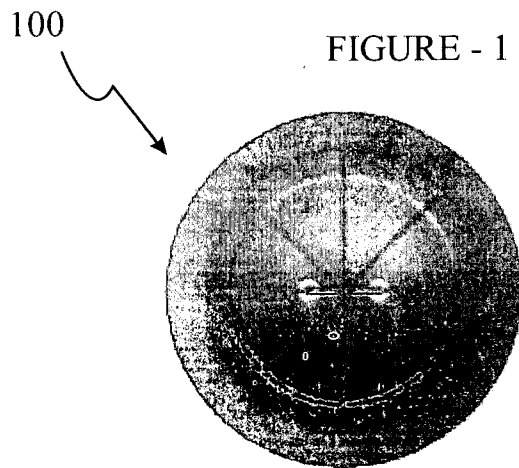


FIGURE - 2

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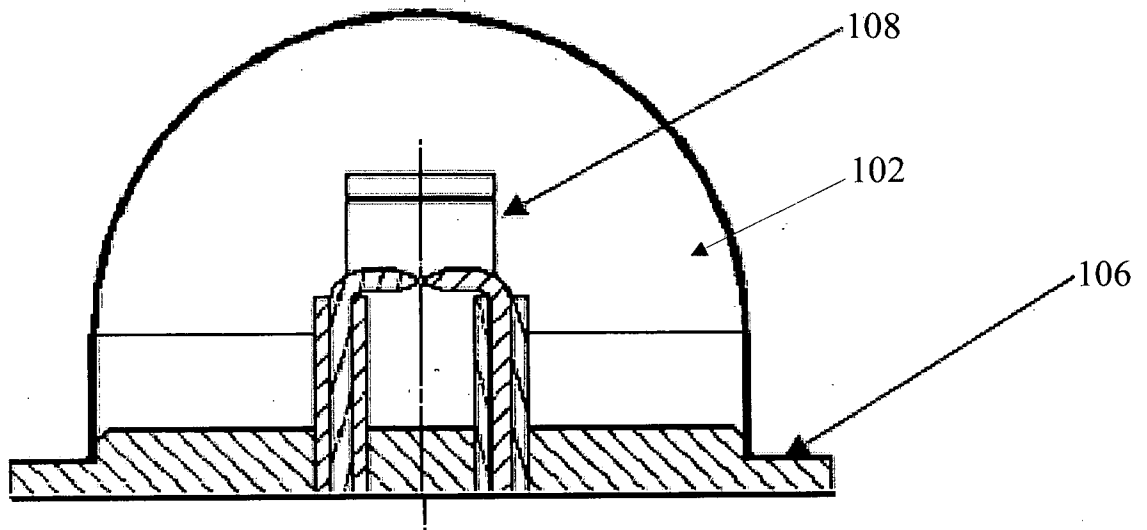


FIGURE - 3

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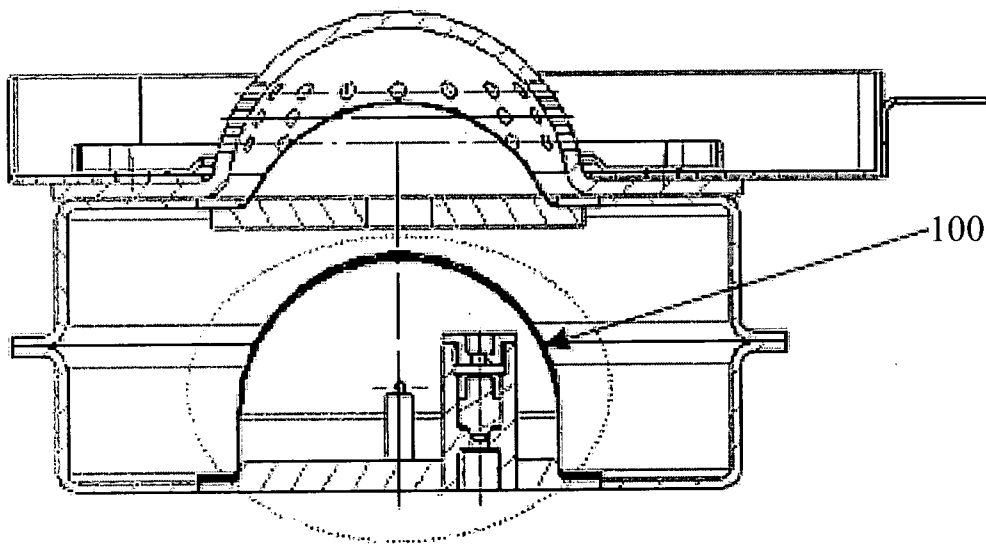


FIGURE - 4

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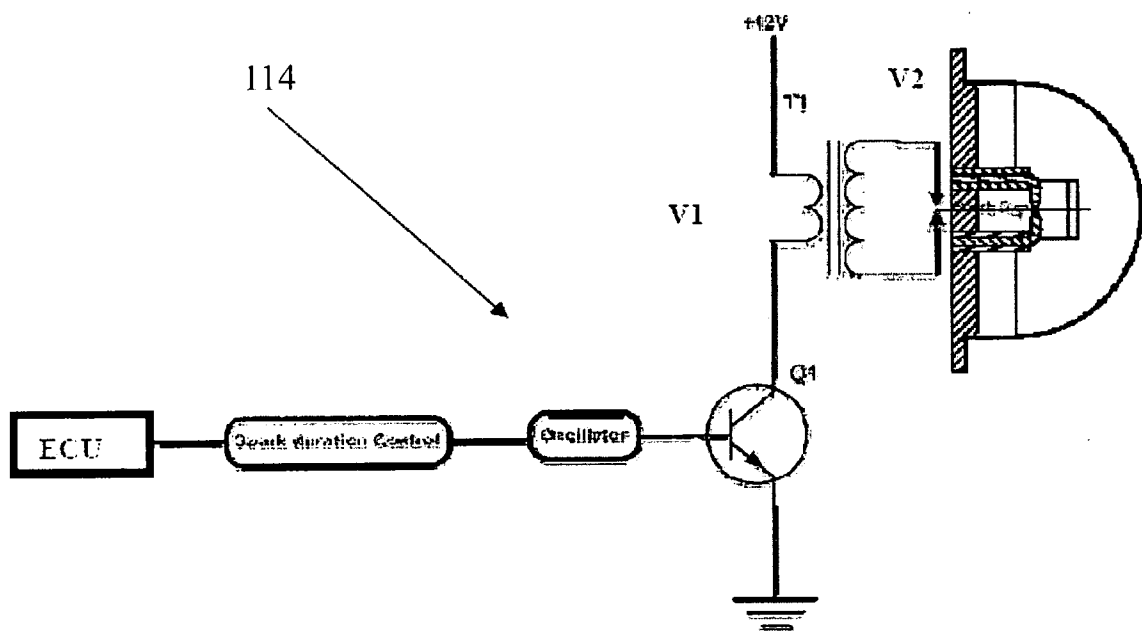


FIGURE - 5