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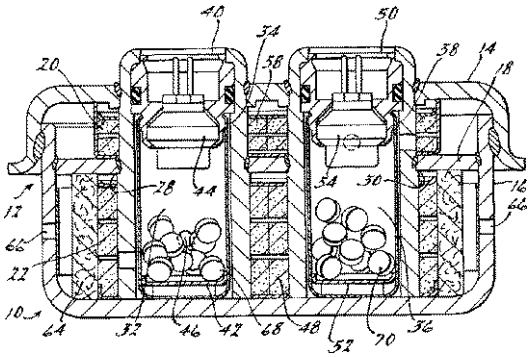
(54)【発明の名称】２チャンバー式インフレータ

(57)【要約】
２チャンバー式インフレータ１０は、ベース１４およびキャップ１６を備えるハウジング１０を含む。仕切り円盤１８は、前記インフレータ１０を第一チャンバー２０と第二チャンバー２２に分割する。仕切り装置１８は、チャンバー２０および２２の同時動作のためそれらの間の液体連通を促進するところの、少なくとも１つの開口部６０を含む。



【特許請求の範囲】
【請求項１】
車両乗員用保護システム用の２チャンバー式インフレータであって、
ベースおよびキャップを含み、さらに該ベースはその周囲に配置された第一複数ガス排出孔を含むハウジング；
前記ベースおよび前記キャップの内部に第一推進剤チャンバーおよび第二推進剤チャンバーをそれぞれ形成するための、前記ベースと前記キャップとの中間にある仕切り装置であって、前記２つのチャンバーを互いに動作的に分離し、そして上端面、下端面、および前記第二チャンバーから前記第一チャンバーへの液体連通を提供する少なくとも一つの開口部を含む、前記仕切り装置；
前記第一チャンバー内に含まれる第一推進剤であって、前記ガス発生装置の始動により燃焼される前記第一推進剤；
前記第二チャンバー内に含まれる第二推進剤であって、状況に応じて前記第一推進剤と同時に燃焼される前記第二推進剤；および
前記下端面上の前記少なくとも一つの開口部を覆って固定され、それにより、衝突時に前記第一チャンバーのみが始動された場合に前記第一チャンバーと前記第二チャンバーの同時の作動を防ぐシール
を含む、前記２チャンバー式インフレータ。
【発明の詳細な説明】
【０００１】
関連出願の相互参照
本出願は２００１年１月２６日に出願された仮出願第60/264,548号の利益を主張する。
【０００２】
発明の背景
本発明は、例えば車両乗員用保護システムのエアバッグを膨張させるのに用いられるガス発生器に関する。本発明は、特に、前記エアバッグが適切に展開されることを保証するために、２チャンバー式インフレータの推進剤チャンバーの分離のための改良された構造を含む改良型２チャンバー式ガス発生器に関する。
【０００３】
自動車内でエアバッグを展開するための膨張システム（inflation system）は、一般的に、膨張していないエアバッグと液体連通している単一のガス発生器を採用している。点火回路は通常、感知された車両加速度が所定のしきい値を超える場合に、加速度反応慣性スイッチを用いて、前記ガス発生器を作動する。
【０００４】
しかしながら、単一のガス発生器を利用するエアバッグ膨張装置は、乗員位置に関連した特定の膨張時間を達成するために、開始時の加圧／膨張速度が、一般に強い初期の膨張をもたらすように設定されるという欠点を有している。強い加圧開始速度は、乗員が正常な位置にいない状況において問題となる。さらに具体的には、エアバッグの開始時の急速な加圧により、乗員に損傷を与えるのに十分な力でエアバッグが乗員に衝撃を与える場合がある。エアバッグ体積および膨張容量は、体の大きな乗員および体の小さな乗員のどちらも保護するように設計されており、通常、単一のガス発生器内では調節可能ではない。これまで、時として、単一のガス発生器を利用するエアバッグが展開する場合、体の小さな乗員、すなわち一般には子供や小柄な女性が重度の損傷を被ることがあった。
【０００５】
共有されている米国特許第5,400,487号は、複数のガス発生器を利用することにより前記の問題を克服する膨張装置を開示しており、前記複数のガス発生器は、制御可能に点火されて、いずれの所与の乗員の体重および／または位置に対して、ならびにいずれの衝突タイプに対しても対処できるような可変膨張プロファイルを提供する。この構成は乗員を保護する膨張装置の性能を劇的に改善するが、それにはかなりの費用および複雑性が必要となる。複数のガス発生器およびスクイブ（squibs）は、装置にかなりの費用を付加し、点

火制御回路は、種々の点火プロファイルを正確に調節することのできる洗練されたプロセッサを必要とする。

【０００６】

共有されている米国特許第5,934,705号に教示される別の提案は、単一のハウジングの両端間の機械的保持壁により画定される２チャンバー（dual chamber）を前記単一のハウジング内に有するガス発生器である。各ハウジングは、推進剤容量および、それにしたがって各チャンバーの膨張能力を決定する所定のサイズを持つ。車両衝突が発生した際に、乗員の体重に応じて片方のチャンバーまたは両方のチャンバーが選択的に点火され、それによって保護エアバッグが膨張される。しかしながら、このような周知の２チャンバー式インフレータの構造の一体性（integrity）は、一方のチャンバーしか点火されない場合に壁が２つのチャンバーの分離に失敗することにより、危険にさらされる場合がある。

【０００７】

上記のように、通常の２チャンバー式インフレータにはより堅固な設計が必要であり、そのため単一チャンバー式インフレータと比較してコストが高く、より複雑な製造方法が要求される。

【０００８】

したがって、簡単な設計を持ちそのために低い材料費と製作費が実現でき、しかもガス発生器の危険な構造的失敗を起こすことなく選択的なエアバッグの膨張加圧が可能であるような、２チャンバー式インフレータが必要とされている。

【０００９】

発明の概要

２チャンバー式インフレータにおける２つのチャンバーの完全な分離は、エアバッグの柔軟な展開には必要不可欠である。そこで本発明は、エアバッグの適切な展開を保証するよう、２チャンバー式インフレータの２つの推進剤チャンバーの分離のために改善された構造に関する。分離された２つの点火剤の集合（igniter assemblies）は、その中での選択的なガス発生のために第一および第二推進剤チャンバーを通って広がる。仕切り円盤（divider disk）は、前記第一および第二チャンバーを、各チャンバーの独立した動作が保証されるように分離する。本発明は、インフレータの安全を確保し製造コストを下げつつ、これら２つのチャンバーの連続的（sequential)または同時の始動を可能にする。

【００１０】

本発明の好ましい態様の詳細な説明

図に示すように、インフレータ１０は、本発明の好ましい態様においては、キャップ１６に溶接または他の方法で固定されているベース１４によって形成されたハウジング１２を含む。仕切り円盤１８は該ハウジング１２を第一チャンバー２０と第二チャンバー２２に分割し、それにより前記第一チャンバー２０は前記ベース１４の中に、前記第二チャンバー２２は前記キャップ１６の中に形成される。

【００１１】

前記ベース１４、キャップ１６、および仕切り円盤１８は好ましくは型打ちしたスチール、または既知で受け入れられている他の方法と材料を用いて形成される。前記ベース１４は第一環（annulus）２４と第二環２６を含む。前記仕切り円盤１８は第三環２８と第四環３０を含み、該第三環と第四環はそれぞれ第一環２４と第二環２６に対応する軸配置を取る。

【００１２】

図に示すように、第一点火チャンバー３２は、第一点火チューブ３４が前記第一環２４に挿入され第三環２８に溶接されて形成され、チューブ３４および環２４と２８の周長（circumference）は実質的に等しい。同様に、第二点火チャンバー３６は、第二点火チューブ３８が前記第二環２６に挿入され第四環３０に溶接されて形成され、チューブ３８および環２６と３０の周長は実質的に等しい。

【００１３】

チャンバー３２は隣接端４０と遠心端４２とを含む。第一点火装置４４は該隣接端４０か

ら挿入されて点火チャンバー３２内に配置される。点火装置４４は好ましくはチューブ３４にクリンプ（crimp）される。少なくとも一つのガス排出孔４６は遠心端４２を通って伸びており、前記第一ガス発生チャンバー２０の内部における、チャンバー３２と第一ガス発生推進剤４８の間の液体連通を促進している。

【００１４】

チャンバー３６は隣接端５０と遠心端５２とを含む。第二点火装置５４は該隣接端５０から挿入されて点火チャンバー３６内に配置される。点火装置５４は好ましくは第二チューブ３８にクリンプ（crimp）される。少なくとも一つのガス排出孔５６は隣接端５０を通って伸びており、前記第二ガス発生チャンバー２２の内部における、点火チャンバー３６と第二ガス発生推進剤５８の間の液体連通を促進している。

【００１５】

環状フィルター６４はチャンバー２２と２２を通る軸の周囲に放射状に配置される。第二複数ガス排出孔６６は、前記ハウジング１２の内部および、前記第一ガス発生チャンバー２０のほぼ内部に、周上かつ側面に均一に配置され、それによって該チャンバー２０とエアバッグ（図示されていない）の間の液体連通を提供する。好ましい態様においては、フォイル（foil）が第三複数ガス排出孔６６の各排出孔を覆い、それによってチャンバー２０を密封している。

【００１６】

図に示すように、前記円盤１８はチューブ３４と３８およびキャップ１６に溶接されている。該チューブ３４と３８自体はさらにキャップ１６に溶接されており、それによって構造の一体性を高めている。

【００１７】

第一開始剤組成物６８は前記第一点火チャンバー３２の内部に備えられる。第二開始剤配合７０は配合６８と同じかまたは異なるが、前記第二点火チャンバー３６の内部に備えられる。

【００１８】

動作に際しては、車両乗員用保護システムは急激な減速または衝突の発生を示す信号を発生し、信号は点火装置４４に感知され、前記第一開始推進剤６８の点火を引き起こす。開始剤配合６８の点火により発生した熱、炎、および燃焼ガスが前期第一ガス発生チャンバー２０に流入し、前記第一ガス発生推進剤４８を点火する。それにより発生したガスはさらにチャンバー２０から流出してフィルター６４を通り、複数排出孔６６からエアバッグ（図示されていない）に流入する。

【００１９】

前記第二チャンバー２２は、衝突の激しさの度合い、乗員位置の感知、乗員の体重および／または身長などの要因に基づき選択的に作動される。前記仕切り円盤１８は、少なくとも１つの開口部および、チャンバー２２からチャンバー２０へ二次的ガスを移すために、好ましくは第一複数ガス排出孔６０を含む。第一バーストシム（burst shim）（例えばスチールまたはアルミニウム）６２は上部または第一円盤表面５７の上の複数ガス排出孔６０を覆い、それによってチャンバー２２を密封し、前記第二チャンバー２２が作動されたときに燃焼圧力が十分に増加するのを促進する。シール６１は密封テープなどで、好ましくは下部または第二円盤表面５９に固定され、それによって炎の前線や熱いガスが下部チャンバー２０から上部チャンバー２２へ移動するのを防止する。このように、乗員の体重が軽い場合には、チャンバー２０が選択され、チャンバー２２が同時に作動されることなくチャンバー２０のみが作動されることになる。

【００２０】

一方、乗員の体重が重い場合には、座席体重センサーおよび／または当該技術分野において知られている乗員位置検知アルゴリズムに基づきチャンバー２０と２２が選択され、同時に作動される。該チャンバー２０と２２の同時作動時には、ガスが前記排出孔６０を通過するにしたがってシール６１の一体性を破り、推進剤５８の燃焼により生成されるガス圧力がバーストシム６２を上回る。このようにして、チャンバー２０と２２で生成された

ガスは、ガス排出孔６６から排出される際にチャンバー２０で混ざり合う。
【００２１】
前記ワイヤメッシュフィルタ６４は、たとえば金属スクリーンの複数の層またはラップから形成することができる。それのみに限定されるものではないが、本願に参照のために組み込まれている米国特許第6,032,979号および第5,727,813号には典型的な金属フィルターが記載されている。
【００２２】
当該技術分野において知られている他のインフレータと比較して、本発明のインフレータは、乗員の体重に基づくチャンバー２０と２２の個別の動作を保証することにより乗員の安全性を高める。さらに、図に示された設計は本質的に保持器（retainers）または位置感知器（locators）を必要としない。したがって、本発明のインフレータは全体でより少ない数の部品を含み、そのため製造を簡便化しより低い製造コストを可能にする。最後に、チャンバー２０のみが選択された場合、本設計は約１５～２０秒後にチャンバー２２の始動を促進する。しかし、これによってエアバッグを再度展開し適切な位置にいない乗員に損傷を与えることはない。なぜならば、チャンバー２０は２つのチャンバーの全ガス発生チャージの少なくとも７０～８０％にあたる一次チャージを含んでおり、そのため、チャンバー２２が付随的に（conductively）または能動的に始動された場合、チャンバー２２にはエアバッグに使用される全推進剤チャージの僅か２０～３０％しか残っていないからである。別の言い方をすれば、チャンバー２２はその始動により、チャンバー２０が提供する一次ガスの力を補強するのみである。チャンバー２２はそれのみでは、乗員を適切に保護するためのエアバッグを展開するのに十分なガス発生を提供できず、そのため、チャンバー２２はチャンバー２０と共同してのみ働くように作動される。
【００２３】
本発明の好ましい態様についての上の記述は例示目的のみであることが理解されよう。したがって、本明細書に開示される種々の構造的かつ動作的特徴は、添付の特許請求の範囲に規定されている本発明の範囲からは逸脱しない、当業者の能力に相応した多数の改変を受けることができる。
【図面の簡単な説明】
【００２４】
【図１】本発明に基づいた２チャンバー式インフレータの上面断面図である。
【図２】図１の２－２の線に沿って作成した断面図である。

【図１】

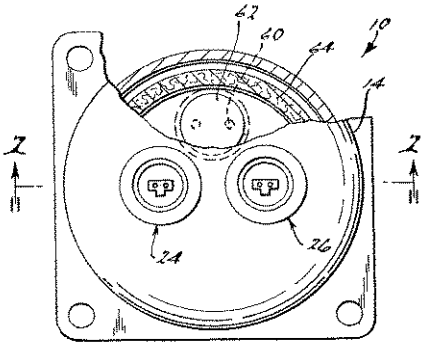

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図1

【図２】

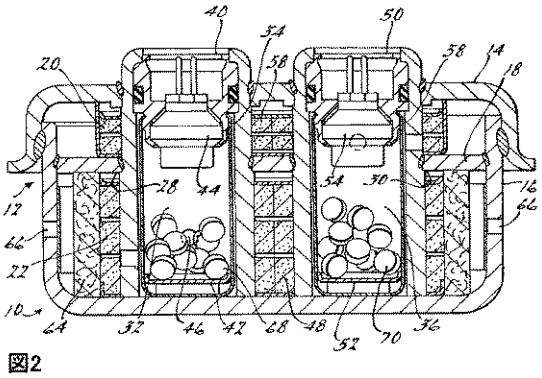
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図2

【国際公開パンフレット】

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(30) Priority Data:
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(72) Inventor: QUIOC, Eduardo, L.; 36640 Ralf, Westland, MI 48185 (US).

(74) Agents: BEGIN, Laurence, C. et al.; Dinnin & Dunn, P.C., Top of Troy Building, 755 West Big Beaver Road, Troy, MI 48084 (US).

(81) Designated State (national): JP.

(84) Designated States (regional): European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

Published:
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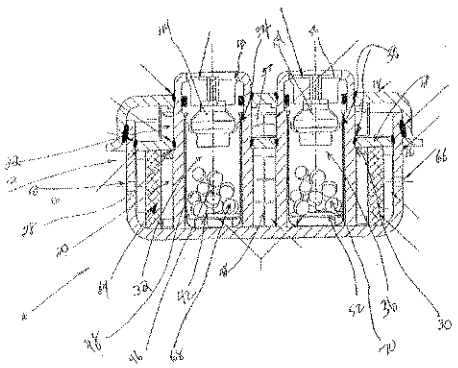
before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: DUAL CHAMBER INFLATOR



(57) Abstract: A dual chamber inflator (10) contains a housing (12) having a base (14) and a cap (16). A divider disc (18) divides the inflator (10) into a first chamber (20) and a second chamber (22). Divider (18) contains at least one aperture (60) thereby facilitating fluid communication between chambers (20 and 22) for simultaneous operation of chambers (20 and 22).

WO 02/058971 A1

DUAL CHAMBER INFLATOR

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of provisional application serial number 60/264,548 filed on January 26, 2001.

BACKGROUND OF THE INVENTION

The present invention relates to gas generators, used to inflate air bags in a vehicle occupant protection system for example, and more particularly, to an improved dual chamber gas generator containing an improved structure for isolating the propellant chambers of a dual chamber inflator so as to ensure proper deployment of the airbag.

Inflation systems for deploying an air bag in a motor vehicle generally employ a single gas generator in fluid communication with an uninflated air bag. A firing circuit typically triggers the gas generator when the sensed vehicle acceleration exceeds a predetermined threshold value, as through the use of an acceleration-responsive inertial switch.

However, air bag inflation systems utilizing a single gas generator suffer from the disadvantage that the onset pressurization/inflation rate is generally set to provide aggressive initial inflation in order to achieve a particular inflation time related to occupant position. An aggressive onset rate of pressurization becomes problematic in situations where the occupant is out of position. More specifically, rapid onset pressurization of the air bag can cause the air bag to impact against the occupant with enough force to injure the occupant. The airbag volume and inflating capacity are designed to protect both large and small occupants and are generally not variable within the single gas generator. Occasionally, when an air bag utilizing a single gas generator is deployed, smaller occupants, usually children and smaller women, have been seriously injured.

Commonly owned U.S. Patent No. 5,400,487 discloses an inflation system which overcomes the above problem by utilizing a plurality of gas generators which are controllably ignited to provide a variable inflation profile which can be tailored to any given occupant weight and/or position and for any crash type. While this arrangement dramatically improves the inflation system's ability to protect an occupant, it does so at significant expense and complexity. The multiple gas generators and squibs add considerable cost to the system, while the firing control circuitry requires sophisticated processors capable of accurately timing the various ignition profiles.

Another proposal, as taught in commonly owned U.S. Patent No. 5,934,705, is a gas generator having two chambers in a single housing defined by a mechanically retained wall between the ends thereof. Each housing is of a predetermined size that is determinative of the propellant capacity and consequently, of the inflating capability of each chamber. Upon the occurrence of a vehicle collision, depending on the weight of the passenger, either chamber or both may be selectively ignited thereby inflating the protective airbag. However, the structural integrity of such a known dual chamber inflator, may be compromised by failure of the wall separating the chambers when only one chamber is fired.

Given the above, typical dual chamber inflators often require a more robust design, resulting in relatively higher costs and more complicated manufacturing as compared to a single chamber inflator.

Therefore, a need exists for a dual chamber gas generator that exhibits a simplified design and therefore lower material and manufacturing costs, and yet can still produce selective air bag inflation pressurization without hazardous structural failure of the gas generator.

SUMMARY OF THE INVENTION

Complete isolation of the chambers of a dual chamber airbag inflator is critical to soft deployment of the airbag. Accordingly, the present invention relates to an improved structure for isolating the propellant chambers of a dual chamber inflator so as to insure proper deployment. Two separate igniter assemblies extend through primary and secondary propellant chambers for selective gas generation therein. A divider disc separates the primary and secondary chambers such that independent operation of each chamber is assured. The present invention permits sequential or simultaneous activation of the two chambers while enhancing the safety of the inflator and reducing the manufacturing costs.

BRIEF DESCRIPTON OF THE DRAWINGS

Figure 1 is a cross-sectional top view of a two-chamber inflator in accordance with the present invention.

Figure 2 is a cross-sectional view taken along the line 2-2 of Figure 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

As seen in the figures, an inflator 10, in accordance with a preferred embodiment of the present invention, contains a housing 12 formed from a base 14 welded or otherwise fixed to a cap 16. A divider disc 18 divides the housing 12 into a primary chamber 20 and a secondary chamber 22, whereby the chamber 20 is formed within the base 14 and the chamber 22 is formed within the cap 16.

The base 14, cap 16, and divider disc 18 are preferably formed from stamped steel, or by other known and accepted methods and materials. The base 14 contains a first annulus 24 and a second annulus 26. The divider disc 18 contains a third annulus 28 and a fourth annulus 30, each in

corresponding axial alignment with first annulus 24 and second annulus 26, respectively.

As shown in the Figures, a first igniter chamber 32 is formed when a first igniter tube 34 is inserted through and welded to the first and third annuli 24 and 28, respectively, wherein tube 34 and annuli 24 and 28 are substantially equal in circumference. Similarly, a second igniter chamber 36 is formed when a second igniter tube 38 is inserted through and welded to the second and fourth annuli 26 and 30, respectively, wherein tube 38 and annuli 26 and 30 are also substantially equal in circumference.

Chamber 32 contains a proximate end 40 and a distal end 42. A first igniter 44 is inserted through the proximate end 40 and is thereby disposed within ignition chamber 32. Igniter 44 is then preferably crimped to tube 34. At least one gas exit aperture 46 extends through distal end 42 thereby facilitating fluid communication between chamber 32 and a primary gas generant propellant 48 within the primary gas generant chamber 20.

Chamber 36 contains a proximate end 50 and a distal end 52. A second igniter 54 is inserted through the proximate end 50 and is thereby disposed within chamber 36. Igniter 54 is then preferably crimped to second tube 38. At least one second gas exit aperture 56 extends through proximate end 50 thereby facilitating fluid communication between ignition chamber 36 and a secondary primary gas generant propellant 58 within the secondary gas generant chamber 22.

An annular filter 64 is peripherally and radially spaced from an axis extending through chambers 20 and 22. A second plurality of gas exit apertures 66 are circumferentially and homolaterally disposed within the housing 12 and about the primary gas generant chamber 20, thereby providing fluid communication between the chamber 20 and an airbag (not shown). In a preferred embodiment, foil covers each aperture in the third plurality of apertures 66, thereby sealing chamber 20.

As shown in the figures, the disc 18 is welded to tubes 34 and 38 and to the cap 16. The tubes 34 and 38 are also welded to the cap 16 thereby enhancing structural integrity.

A first initiator composition 68 is provided within the first ignition chamber 32. A second initiator composition 70, the same as or different from composition 68, is provided within the second chamber 36.

In operation, a vehicle occupant protection system generates a signal indicating sudden deceleration or a crash event that is then sensed by igniter 44 thereby triggering ignition of the first initiator propellant 68. Upon ignition of composition 68, the heat, flame, and combustion gases produced flow into the primary gas generant chamber 20 thereby igniting the primary gas generant propellant 48. The resultant gases then flow from chamber 20 through filter 64 and out apertures 66 into an airbag (not shown).

The second chamber 22 is selectively operated based on factors such as crash severity, occupant position sensing, and the weight and/or height of the occupant. The divider disc 18 contains at least one aperture and preferably a first plurality of gas exit apertures 60 for transfer of secondary gas from chamber 22 into chamber 20. A first burst shim (e.g. steel or aluminum) 62 covers the plurality of apertures 60 on an upper or first disc surface 57 thereby sealing chamber 22 and facilitating a sufficient increase in combustion pressure when the second chamber 22 is activated. A seal 61, such as sealing tape, is preferably fixed to a lower or second disc surface 59 thereby preventing flame front and hot gases from migrating from the lower chamber 20 into the upper chamber 22. As such, given a lower weight occupant, chamber 20 may be selected to singularly operate without simultaneous operation of chamber 22.

On the other hand, given a heavier occupant, chambers 20 and 22 may be selected to simultaneously operate based on seat weight sensor and/or occupant position sensing algorithms known in the art. During simultaneous operation of the chambers 20 and 22, gas pressure produced from combustion of propellant 58 overcomes the burst shim 62 as gas passes through the

aperture(s) 60 breaking the integrity of the seal 61. As such, gas produced from chambers 20 and 22 co-mingle in chamber 20 as they exit the gas exit apertures 66.

The wire mesh filter 64 can be formed from multiple layers or wraps of metal screen, for example. Although not limited thereby, U.S. Patent Nos. 6,032,979 and 5,727,813, herein incorporated by reference, illustrate typical metal filters.

When compared to other inflators known in the art, the present inflator enhances the safety of the occupant by ensuring discrete operation of chambers 20 and 22 based on the weight of the occupant. Additionally, the design indicated in the figures inherently requires no retainers or locators. Therefore, the present inflator contains less parts overall and therefore simplifies manufacturing at a lower cost. Finally, should only chamber 20 be selected, the present design facilitates the activation of chamber 22 after about 15-20 seconds. However, there is no likelihood of redeploying the airbag and injuring an out-of-position occupant because chamber 20 contains a primary charge representing at least 70-80% of the total gas generant charge between the two chambers. Therefore, when chamber 22 is conductively or passively activated, there is only 20-30% of the overall propellant charge acting on the airbag. Stated another way, chamber 22 merely augments the primary gas force provided by chamber 20 upon activation. Chamber 22 would not singularly provide enough gas generation to effect the airbag inflation necessary to adequately protect the occupant, and therefore, it is only actively operated to work in conjunction with chamber 20.

It will be understood that the foregoing description of the preferred embodiment of the present invention is for illustrative purposes only. As such, the various structural and operational features herein disclosed are susceptible to a number of modifications commensurate with the abilities of one of ordinary skill in the art, none of which departs from the scope of the present invention as defined in the appended claims.

WHAT IS CLAIMED IS:

1. A dual chamber inflator for a vehicle occupant protection system comprising:

a housing comprising a base and a cap, said base further comprising a first plurality of gas exit apertures peripherally spaced therein;

a divider intermediate of said base and said cap for forming a first propellant chamber and a second propellant chamber within said base and said cap, respectively, said chambers operatively separated from each other, and, said divider comprising a top surface, a bottom surface, and at least one aperture providing fluid communication from the second chamber to the first propellant chamber;

a first propellant contained within said first chamber, said first propellant combusted upon activation of said gas generator;

a second propellant contained within said second chamber, said second propellant optionally combusted simultaneously with said first propellant; and

a seal fixed over said at least one aperture on said bottom surface thereby preventing simultaneous operation of said first chamber and said second chamber when only said first chamber is activated upon a crash event.

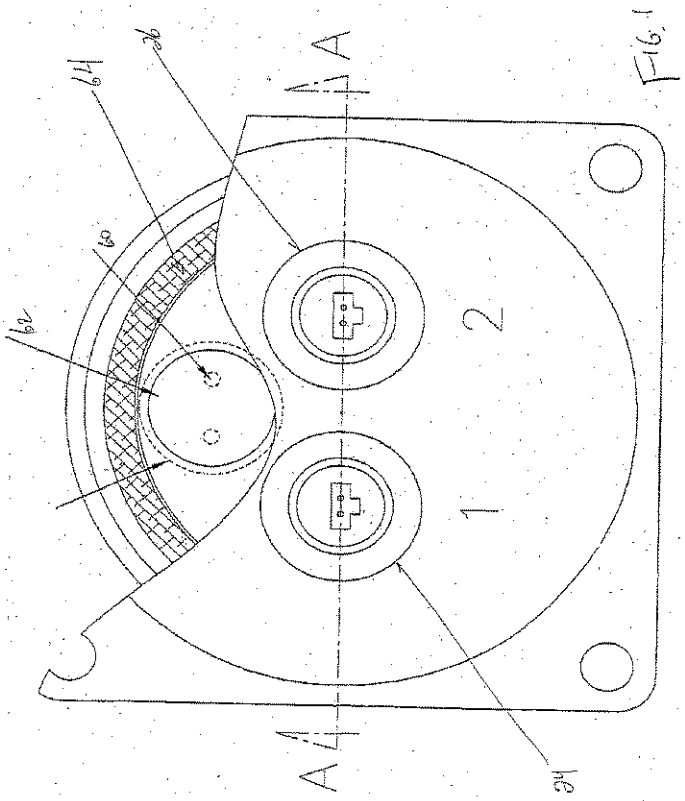


FIG. 1

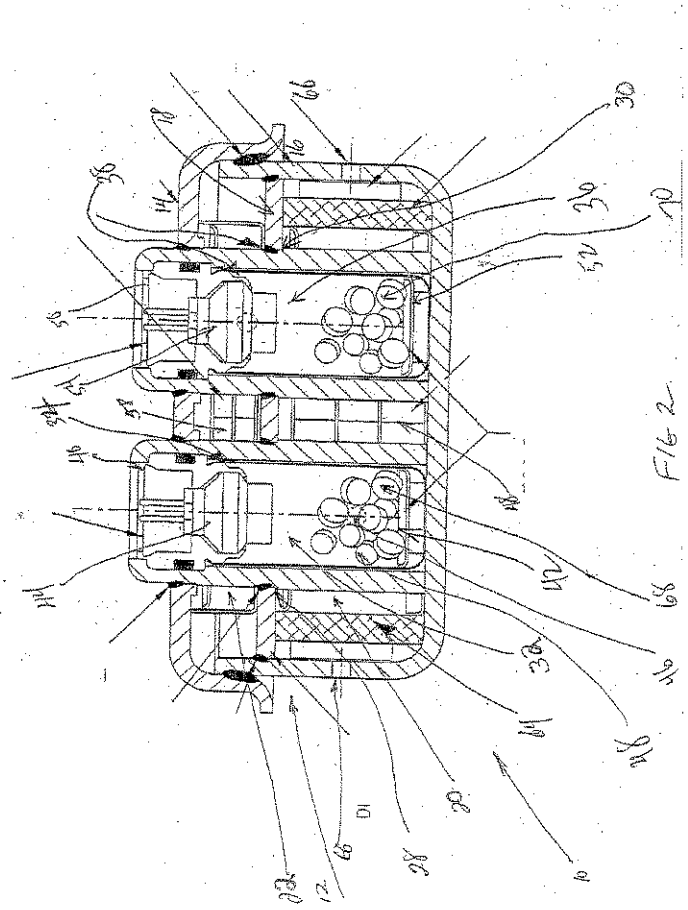


FIG 2

【国際公開パンフレット（コレクトバージョン）】

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

CORRECTED VERSION

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(81) Designated State (national): JP.

(84) Designated States (regional): European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

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see PCT Gazette No. 23/2003 of 5 June 2003, Section II

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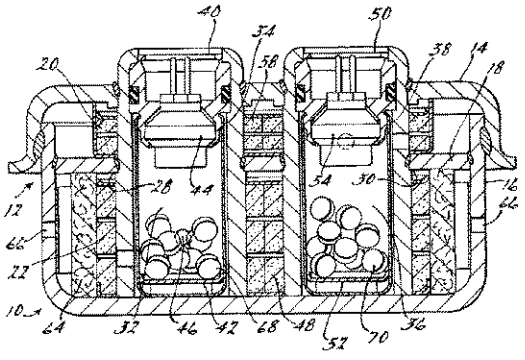
(54) Title: DUAL CHAMBER INFLATOR



(57) Abstract: A dual chamber inflator (10) contains a housing (12) having a base (14) and a cap (16). A divider disc (18) divides the inflator (10) into a first chamber (20) and a second chamber (22). Divider (18) contains at least one aperture (60) thereby facilitating fluid communication between chambers (20 and 22) for simultaneous operation of chambers (20 and 22).

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DUAL CHAMBER INFLATOR

CROSS REFERENCE TO RELATED APPLICATIONS

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BACKGROUND OF THE INVENTION

The present invention relates to gas generators, used to inflate air bags in a vehicle occupant protection system for example, and more particularly, to an improved dual chamber gas generator containing an improved structure for isolating the propellant chambers of a dual chamber inflator so as to ensure proper deployment of the airbag.

Inflation systems for deploying an air bag in a motor vehicle generally employ a single gas generator in fluid communication with an uninflated air bag. A firing circuit typically triggers the gas generator when the sensed vehicle acceleration exceeds a predetermined threshold value, as through the use of an acceleration-responsive inertial switch.

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Commonly owned U.S. Patent No. 5,400,487 discloses an inflation system which overcomes the above problem by utilizing a plurality of gas generators which are controllably ignited to provide a variable inflation profile which can be tailored to any given occupant weight and/or position and for any crash type. While this arrangement dramatically improves the inflation system's ability to protect an occupant, it does so at significant expense and complexity. The multiple gas generators and squibs add considerable cost to the system, while the firing control circuitry requires sophisticated processors capable of accurately timing the various ignition profiles.

Another proposal, as taught in commonly owned U.S. Patent No. 5,934,705, is a gas generator having two chambers in a single housing defined by a mechanically retained wall between the ends thereof. Each housing is of a predetermined size that is determinative of the propellant capacity and consequently, of the inflating capability of each chamber. Upon the occurrence of a vehicle collision, depending on the weight of the passenger, either chamber or both may be selectively ignited thereby inflating the protective airbag. However, the structural integrity of such a known dual chamber inflator, may be compromised by failure of the wall separating the chambers when only one chamber is fired.

Given the above, typical dual chamber inflators often require a more robust design, resulting in relatively higher costs and more complicated manufacturing as compared to a single chamber inflator.

Therefore, a need exists for a dual chamber gas generator that exhibits a simplified design and therefore lower material and manufacturing costs, and yet can still produce selective air bag inflation pressurization without hazardous structural failure of the gas generator.

SUMMARY OF THE INVENTION

Complete isolation of the chambers of a dual chamber airbag inflator is critical to soft deployment of the airbag. Accordingly, the present invention relates to an improved structure for isolating the propellant chambers of a dual chamber inflator so as to insure proper deployment. Two separate igniter assemblies extend through primary and secondary propellant chambers for selective gas generation therein. A divider disc separates the primary and secondary chambers such that independent operation of each chamber is assured. The present invention permits sequential or simultaneous activation of the two chambers while enhancing the safety of the inflator and reducing the manufacturing costs.

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Figure 2 is a cross-sectional view taken along the line 2-2 of Figure 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

As seen in the figures, an inflator 10, in accordance with a preferred embodiment of the present invention, contains a housing 12 formed from a base 14 welded or otherwise fixed to a cap 16. A divider disc 18 divides the housing 12 into a primary chamber 20 and a secondary chamber 22, whereby the chamber 20 is formed within the base 14 and the chamber 22 is formed within the cap 16.

The base 14, cap 16, and divider disc 18 are preferably formed from stamped steel, or by other known and accepted methods and materials. The base 14 contains a first annulus 24 and a second annulus 26. The divider disc 18 contains a third annulus 28 and a fourth annulus 30, each in

corresponding axial alignment with first annulus 24 and second annulus 26, respectively.

As shown in the Figures, a first igniter chamber 32 is formed when a first igniter tube 34 is inserted through and welded to the first and third annuli 24 and 28, respectively, wherein tube 34 and annuli 24 and 28 are substantially equal in circumference. Similarly, a second igniter chamber 36 is formed when a second igniter tube 38 is inserted through and welded to the second and fourth annuli 26 and 30, respectively, wherein tube 38 and annuli 26 and 30 are also substantially equal in circumference.

Chamber 32 contains a proximate end 40 and a distal end 42. A first igniter 44 is inserted through the proximate end 40 and is thereby disposed within ignition chamber 32. Igniter 44 is then preferably crimped to tube 34. At least one gas exit aperture 46 extends through distal end 42 thereby facilitating fluid communication between chamber 32 and a primary gas generant propellant 48 within the primary gas generant chamber 20.

Chamber 36 contains a proximate end 50 and a distal end 52. A second igniter 54 is inserted through the proximate end 50 and is thereby disposed within chamber 36. Igniter 54 is then preferably crimped to second tube 38. At least one second gas exit aperture 56 extends through proximate end 50 thereby facilitating fluid communication between ignition chamber 36 and a secondary primary gas generant propellant 58 within the secondary gas generant chamber 22.

An annular filter 64 is peripherally and radially spaced from an axis extending through chambers 20 and 22. A second plurality of gas exit apertures 66 are circumferentially and homolaterally disposed within the housing 12 and about the primary gas generant chamber 20, thereby providing fluid communication between the chamber 20 and an airbag (not shown). In a preferred embodiment, foil covers each aperture in the third plurality of apertures 66, thereby sealing chamber 20.

As shown in the figures, the disc 18 is welded to tubes 34 and 38 and to the cap 16. The tubes 34 and 38 are also welded to the cap 16 thereby enhancing structural integrity.

A first initiator composition 68 is provided within the first ignition chamber 32. A second initiator composition 70, the same as or different from composition 68, is provided within the second chamber 36.

In operation, a vehicle occupant protection system generates a signal indicating sudden deceleration or a crash event that is then sensed by igniter 44 thereby triggering ignition of the first initiator propellant 68. Upon ignition of composition 68, the heat, flame, and combustion gases produced flow into the primary gas generant chamber 20 thereby igniting the primary gas generant propellant 48. The resultant gases then flow from chamber 20 through filter 64 and out apertures 66 into an airbag (not shown).

The second chamber 22 is selectively operated based on factors such as crash severity, occupant position sensing, and the weight and/or height of the occupant. The divider disc 18 contains at least one aperture and preferably a first plurality of gas exit apertures 60 for transfer of secondary gas from chamber 22 into chamber 20. A first burst shim (e.g. steel or aluminum) 62 covers the plurality of apertures 60 on an upper or first disc surface 57 thereby sealing chamber 22 and facilitating a sufficient increase in combustion pressure when the second chamber 22 is activated. A seal 61, such as sealing tape, is preferably fixed to a lower or second disc surface 59 thereby preventing flame front and hot gases from migrating from the lower chamber 20 into the upper chamber 22. As such, given a lower weight occupant, chamber 20 may be selected to singularly operate without simultaneous operation of chamber 22.

On the other hand, given a heavier occupant, chambers 20 and 22 may be selected to simultaneously operate based on seat weight sensor and/or occupant position sensing algorithms known in the art. During simultaneous operation of the chambers 20 and 22, gas pressure produced from combustion of propellant 58 overcomes the burst shim 62 as gas passes through the

aperture(s) 60 breaking the integrity of the seal 61. As such, gas produced from chambers 20 and 22 co-mingle in chamber 20 as they exit the gas exit apertures 66.

The wire mesh filter 64 can be formed from multiple layers or wraps of metal screen, for example. Although not limited thereby, U.S. Patent Nos. 6,032,979 and 5,727,813, herein incorporated by reference, illustrate typical metal filters.

When compared to other inflators known in the art, the present inflator enhances the safety of the occupant by ensuring discrete operation of chambers 20 and 22 based on the weight of the occupant. Additionally, the design indicated in the figures inherently requires no retainers or locators. Therefore, the present inflator contains less parts overall and therefore simplifies manufacturing at a lower cost. Finally, should only chamber 20 be selected, the present design facilitates the activation of chamber 22 after about 15-20 seconds. However, there is no likelihood of redeploying the airbag and injuring an out-of-position occupant because chamber 20 contains a primary charge representing at least 70-80% of the total gas generant charge between the two chambers. Therefore, when chamber 22 is conductively or passively activated, there is only 20-30% of the overall propellant charge acting on the airbag. Stated another way, chamber 22 merely augments the primary gas force provided by chamber 20 upon activation. Chamber 22 would not singularly provide enough gas generation to effect the airbag inflation necessary to adequately protect the occupant, and therefore, it is only actively operated to work in conjunction with chamber 20.

It will be understood that the foregoing description of the preferred embodiment of the present invention is for illustrative purposes only. As such, the various structural and operational features herein disclosed are susceptible to a number of modifications commensurate with the abilities of one of ordinary skill in the art, none of which departs from the scope of the present invention as defined in the appended claims.

WHAT IS CLAIMED IS:

1. A dual chamber inflator for a vehicle occupant protection system comprising:

a housing comprising a base and a cap, said base further comprising a first plurality of gas exit apertures peripherally spaced therein;

a divider intermediate of said base and said cap for forming a first propellant chamber and a second propellant chamber within said base and said cap, respectively, said chambers operatively separated from each other, and, said divider comprising a top surface, a bottom surface, and at least one aperture providing fluid communication from the second chamber to the first propellant chamber;

a first propellant contained within said first chamber, said first propellant combusted upon activation of said gas generator;

a second propellant contained within said second chamber, said second propellant optionally combusted simultaneously with said first propellant; and

a seal fixed over said at least one aperture on said bottom surface thereby preventing simultaneous operation of said first chamber and said second chamber when only said first chamber is activated upon a crash event.

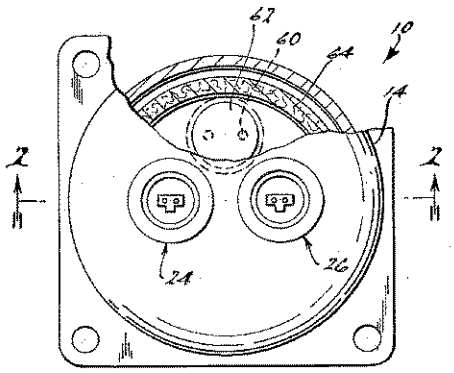
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FIG. 1.

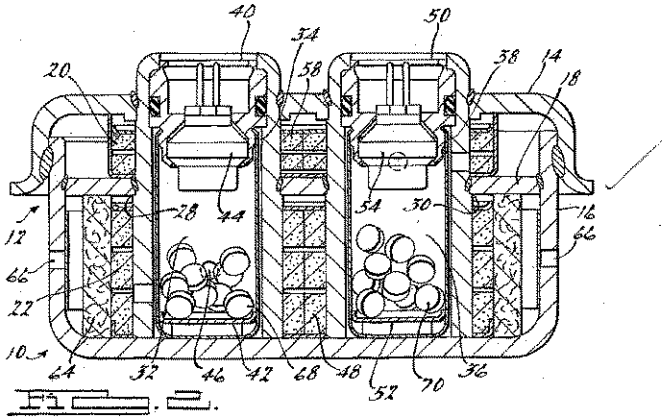
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FIG. 2.

【手続補正書】
【提出日】平成14年8月22日(2002.8.22)
【手続補正１】
【補正対象書類名】特許請求の範囲
【補正対象項目名】全文
【補正方法】変更
【補正の内容】
【特許請求の範囲】
【請求項１】
車両乗員用保護システム用の２チャンバー式インフレータであって、
ベースおよびキャップを含み、さらに該ベースはその周囲に配置された第一複数ガス排出孔を含むハウジング；
前記ベースおよび前記キャップの内部に第一側方推進剤チャンバーおよび第二側方推進剤チャンバーをそれぞれ形成するための、前記ベースと前記キャップとの中間にある仕切り装置であって、前記２つのチャンバーを互いに物理的にかつ動作的に分離し、そして上端面、下端面、および前記第二チャンバーから前記第一チャンバーへの液体連通を提供する少なくとも一つの開口部を含む、前記仕切り装置；
前記第一チャンバー内に含まれる第一推進剤であって、前記ガス発生装置の始動により燃焼される前記第一推進剤；
前記第二チャンバー内に含まれる第二推進剤であって、状況に応じて前記第一推進剤と同時に燃焼される前記第二推進剤；および
前記下端面上の前記少なくとも一つの開口部を覆って固定され、それにより、衝突時に前記第一チャンバーのみが始動された場合に前記第一チャンバーと前記第二チャンバーの同時の作動を防ぐシール
を含む、前記２チャンバー式インフレータ。

【国際調査報告】

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US02/02399

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : B60R 21/26
US CL : 280/741
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)
U.S. : 280/741, 736, 742

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to clai
X	US 6,032,979 A (MOSSI et al)07March 2000 (07.03.2000), figure 1.	1
A, P	US 6,199,906 B1 (TREVILLYAN et al) 13 March 2001 (13.03.2001), figure 1.	1
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A, P	US 6,227,565 B1 (MCFARLAND et al)08May 2001 (08.05.2001), figure 3.	1
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☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
20 May 2002 (20.05.2002)	12 JUN 2002
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230	Authorized officer Paul Dickson Telephone No. 703-305-1113

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