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(54) Orientationless squib connector assembly for automotive air bag assemblies

Richtungsfreie Zündpille-Anschlusseinrichtung für Kraftfahrzeug-Luftsacksysteme

Ensemble connecteur d’amorce exempt d’orientation pour ensembles airbag d’automobiles

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- US-B1- 6 203 342

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Description

[0001] Air bag assemblies are a common safety feature on virtually all motor vehicles of recent vintage. Air bag assemblies comprise an inflatable canister located in the vehicle steering column, dashboard, door panels or seats. In the event of sudden deceleration, the canister is inflated by a gunpowder-based explosive device known as a squib. Sensors located in the vehicle detect the deceleration and fire the squib electronically via a signal sent through wires that are attached to the squib via a squib connector assembly. Squib assemblies are also used in other locations in a vehicle, such as in seat belt pretensioner devices, which "lock" the seat belt in position during sudden deceleration.

[0002] Many types of squib connector assemblies have been developed. In most cases, the assembly must be oriented rotationally relative to the squib socket to ensure that the connector and its mating socket are in the correct clocking position so that proper electrical connections are made. This need to orient the squib connector requires that the connector be provided with keying features or other means to ensure that the connector is attached properly.

[0003] Also known are squib connectors that do not require the connector to be rotationally oriented in any particular manner relative to the squib socket (See e.g., US-A-5,993,230). These squib connectors, aptly termed "orientationless" connectors, are preferred because they facilitate the speed and accuracy of manufacture of the squib assembly. In particular, one of the biggest advantages in using orientationless squib connectors is in the installation of the connector into the inflator housing. Use of orientationless connectors saves time and also reduces the potential for squib pin damage during mating. In addition, the orientationless connectors do not require keying features and thus are usually less costly to manufacture than oriented squib connectors.

[0004] US-B-6 203 342 discloses an orientationless squib socket connector assembly for motor vehicle air bag assemblies. It comprises a squib socket having a cylindrical internal socket wall and a single initiator pin disposed axially within the socket. An annular grounding plate surrounds the initiator pin at the base of the socket. The squib connector of the assembly includes an axially located female contact for electrical connection with the initiator pin and a ground contact projecting from the front face of the tip of the squib connector for electrical connection with the ground plate in the base of the socket. Hence, the ground contact of the connector and the grounding plate of the socket can engage irrespective of the rotational orientation in which the connector is engaged with the socket.

[0005] US-A-5 273 457 describes a connector arrangement for electrically connecting a coaxial cable to the blades of a wiring backplane in which a contact blade carrying an electrical signal is surrounded by contact blades connected to the shielding potential. A plug of the arrangement comprises an inner contact connected to the inner conductor of a coaxial cable and a collar having outwardly bent spring tongues disposed about the inner contact and connected to the braid shielding of the cable. When the arrangement is assembled, the inner contact of the plug engages the signal carrying contact blade of the backplane and the spring tongues of the plug bear against contact blades at the shielding potential.

[0006] The present invention consists in an orientationless squib connector assembly for a motor vehicle air bag assembly, comprising

(a) a squib socket having a cylindrical internal socket wall, a male contact disposed coaxially within the internal socket wall, and an annular ground contact, and
(b) a squib connector including a housing having a longitudinal axis and a tip receivable within the cylindrical internal socket wall of the squib socket, a female contact disposed within the tip for mating engagement with the male contact, and a ground contact engageable with the annular ground contact of the squib socket, characterised in that the annular ground contact of the squib socket comprises a grounding surface disposed on the cylindrical internal socket wall thereof and the ground contact of the squib connector comprises at least one resilient spring beam disposed on an external side surface of the housing tip at a location transverse to the longitudinal axis of the connector housing.

[0007] Preferably, the squib connector is of an axial in-line design, meaning that the pair of electrical wires entering the connector assembly are aligned parallel to the longitudinal axis of the connector. In a preferred embodiment, the connector further comprises a ferrite block located within the housing such that lead wires connected to the female and ground terminals pass through the ferrite block.

[0008] The housing is preferably of a two-piece design comprising upper and lower members, with at least one of the upper or lower members including resilient latching means to secure the housing members together. The housing is also preferably provided with external latching tabs to secure the connector in the squib socket.

[0009] In a particularly preferred embodiment, the ground contact of the squib connector comprises a circumferential cage having a plurality of resilient spring contacts. In this embodiment, the ground contact is disposed over, and surrounds, the tip of the nose body.

[0010] The invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is an exploded perspective view of the
squirb connector of one embodiment of the invention.

Figure 2 is a perspective view of the squirb connector of Figure 1, shown fully assembled.

Figure 3 is an exploded perspective view of a preferred embodiment of the invention.

Figure 4 is a perspective view of the squirb connector of Figure 3, shown fully assembled.

Figures 5A-5E are a series of views depicting the assembly of the preferred embodiment of the invention.

Figure 6 is a partly sectioned, perspective view of the squirb connector of Figure 3 shown seated in the squirb socket.

[0011] With reference first being made to Figures 1 and 2, the connector 10 comprises a housing 11, consisting of an upper housing 12 and lower housing 14, a ferrite block 16, a female contact 18 and a ground contact 20. The female and ground contacts, respectively, terminate electrical conductors or wires 22, 24. The wires 22, 24 are disposed within respective through holes 26, 28 in the ferrite block 16. The ferrite block 16 is positioned within a cavity 30 in the housing components 12, 14. Accordingly, when assembled, the wires 22, 24 are disposed in side-by-side relationship along the longitudinal axis of the connector 10.

[0012] The interior of the housing components 12, 14, as seen in Figure 1, are provided with wire chases 32, 34 both forward and rearward of the ferrite block cavity 30. The wire chases 32, 34 maintain the side-by-side orientation of the wires 22, 24 in the housing 11. The section of wire chases 32, 34 rearwardly of the cavity 30 are further provided with stress relieving members 36 to relieve stress on the contacts 18, 20 and on wires 22, 24. In the section of wire chase 32 forward of the cavity 30, a stop boss 38 is provided which prevents female contact 18 from moving into the housing 11 when mated with a male contact, such as pin 40 in the squirb socket 300 (See Figure 6).

[0013] In order to secure the housing components 12, 14 together, latching tabs 42, 48 are provided on the upper housing 12 and lower housing 14, respectively. Latching tabs 42 cooperate with latching shoulders 46 on the lower housing 14 while latching tab 48 cooperates with latching boss 50 on upper housing 12. It will be appreciated that the number, position and form of latching means to secure the housing components 12, 14 together is not particularly critical to the invention, and other means of securing the housing components 12, 14 together, including the use of adhesives or the like, may be employed and are within the scope of this invention.

[0014] The housing components 12, 14 are also provided with latching ears 52, one disposed on each of the upper and lower housings 12, 14. As seen in Figure 6, these latching ears 52 cooperate with notches 54 in the squirb socket 300 to maintain the squirb connector 10 in position within the socket 300. It will be recognized by those skilled in the art that the housing components 12, 14 may be of molded plastic construction and may be hermaphroditic to reduce manufacturing and inventory costs and to facilitate assembly.

[0015] In the embodiment shown in the Figures, the female contact 18 comprises a generally rectangular, box-shaped receptacle that is in electrical and mechanical contact with the conductor of wire 22. Such contacts are well known in the art and need not be discussed in further detail. Examples of such contacts include those described in WO 98/18181 and the Micro Quadlok™ System commercially available from Tyco Electronics, Harrisburg, PA. It will be understood that any suitable female contact may be employed within the scope of the invention.

[0016] The ground contact 20, in the embodiment shown in Figures 1 & 2, comprises a stamped and formed piece of metal in electrical and mechanical contact with the conductor of wire 24. Ground contact 20, as seen in Figure 1, has a tongue portion 55 that is folded back upon itself to form a leaf beam 56. The leaf beam 56 has a bow shaped bend, giving the leaf beam a resilient property. As seen in Figure 2, when the connector 10 is assembled, the leaf beam 56 is disposed within a slot 58 in a nose or tip section 60 of housing 11 and projects beyond the housing 11.

[0017] When the squib connector is mated with the squib socket, the electrical power connection is made by male contact 40 (Figure 6) being engaged with female contact 18 via aperture 62 in nose section 60 of the connector 10. This electrical power connection thus occurs in an orientation that is parallel to the longitudinal axis of the connector 10. The electrical ground connection occurs between leaf beam 56 of ground contact 20 and grounding surface 64 located within the squib socket 300 (see Figure 6). Because the leaf beam 56 projects away from a side surface of the tip 60, it will be appreciated that the ground connection is oriented transverse to the longitudinal axis of the connector and 90 degrees from the power connection. However, the power and electrical connections still occur in planes that are parallel to one another; i.e., the plane of the grounding surface 64 is in spaced, substantially parallel relationship to the plane of the male contact 40. It will also be appreciated that the grounding connection occurs external to the connector 10 while the power connection occurs internal to the connector 10.

[0018] In the embodiment shown in Figure 6, the grounding surface 64 comprises an annular ring that surrounds the tip 60 of the housing 11. It will be understood that alternative arrangements are possible, although not preferred because then orientation of the connector 10 relative to the socket 300 would be required. In the event an oriented arrangement is used, it would be advantageous to provide the housing components 12, 14 with a keyway 65 or other indicia of orientation, as seen in Figures 1 and 2.
[0019] Turning now to Figures 3-6, the preferred embodiment of the invention will be described. It is noted at the onset that the embodiment of Figures 1-2 is similar in many respects to the preferred embodiment of Figures 3-6 and both share many of the same components. To avoid confusion, the same reference characters will be used for identical components and new reference characters will be used only where the components differ from one embodiment to the other. The description of such components set forth above is equally applicable to the preferred embodiments.

[0020] In the preferred embodiment, the connector 210 comprises a housing 211 having upper and lower housing pieces or components 212, 214, respectively, and a nose body 70. The nose body 70 is a substantially cylindrical shaped member that, when assembled, is partly disposed in the housing 211. The portion of nose body 70 that is not disposed in the housing 211 extends therefrom to form the tip or nose section of the connector, as shown in Figure 4. The nose body 70 has a tip 72 and a base 74. The base 74 is provided with slots 78 which cooperate with ribs 80 as a means of retaining the nose body in the housing 211.

[0021] As in the previous embodiment, the housing components 212, 214 are provided with latching means 42, 46, 48 and 50 to secure the housing components together, as well as latching ears 52 to secure the squib connector 210 in the squib socket 300. In addition, the housing components 212, 214 are provided with wire chases 32, rearwardly of the cavity 30 for the ferrite block 16, and the strain relief members 36.

[0022] The nose section 70 is provided with a longitudinal bore 82 that is sized to receive therein the female contact 18. The ground contact 84, in the preferred embodiment, comprises a cage like member 84 that is mechanically and electrically connected to the conductor wire 24. The cage 84 comprises a plurality of spaced apart resilient beams 86 arranged in a circular configuration and held together by annular bands 88, 90, one at either end of the beams 86. The cage 84 is sized to fit over the section of nose body 70 that is intermediate the tip 72 and the base portion 74. When assembled, the cage 84 is positioned outside of the housing 211, as seen in Figures 4 and 6.

[0023] With reference now being made to Figures 5A-5E, the assembly of the connector 210 will be described. The following description is for illustration only, and should not be construed in any sense as a limitation on the invention. Those skilled in the art will appreciate that alternative processes are available to assemble the connector. The female contact 18 is mechanically and electrically connected, such as by crimping, to the wire 22. The female contact 18 is then inserted into the longitudinal bore 82 in the nose body 70 from the base end 74 of the nose body. The ground contact 83 is mechanically and electrically connected, such as by crimping, to the wire 24. Then, the tip 72 of the nose body 70 is inserted into the cage 84 of the ground contact 83, as seen in Figure 5B. The wires 22, 24 are then inserted into the ferrite block 16, as seen in Figure 5C. The contacts, ferrite block, nose body and wires are then positioned within the housing components 212, 214 and the housing components are secured together via latching means 42, 46, 48 and 50. As seen in Figure 6, the assembled squib connector 210 is then inserted into the squib socket 300 whereby the male contact 40 is mated with the female contact, the ground contact 86 is mated with grounding surface 64 and the latching ears 52 engage the latch recesses 54 to secure the squib connector in position.

Claims

1. An orientationless squib connector assembly for a motor vehicle air bag assembly, comprising

(a) a squib socket (300) having a male contact (40) disposed coaxially within the socket, and a grounding surface (64) disposed therein, and
(b) a squib connector (10,210) including a housing (11,211) having a longitudinal axis and a tip (60) receivable within the squib socket, a female contact (18) disposed within the tip for mating engagement with the male contact (40), and a ground contact (20,84) engageable with the grounding surface (64) of the squib socket, characterised in that

the grounding surface (64) comprises an annular ring within the socket which surrounds the tip (60) of the connector housing (11,211), and the ground contact of the squib connector comprises at least one resilient spring beam (56,86) disposed on an external side surface of the housing tip at a location transverse to the longitudinal axis of the connector housing.

2. The assembly of claim 1, wherein the ground contact of the squib connector comprises a substantially cylindrical cage (84) having a plurality of spring beams (86) disposed in spaced relation and defining a circumference of said cage.

3. The assembly of claim 1 or 2, wherein the housing (11,211) comprises an upper housing (12,212) and a lower housing (14,214) secured together.

4. The assembly of claim 3, wherein the upper and lower housings are secured together by latching means (42,46,48) formed integrally with the upper and lower housings.

5. The assembly claim 3 or 4, including a nose body (70) partially disposed between the upper housing (212) and the lower housing (214), a portion of said
nose body projecting beyond the housing and comprising said tip.

6. The assembly of any preceding claim, including a ferrite block (16) disposed within the housing (11, 211), said ferrite block being disposed around a portion of a pair of electrical wires (22, 24), each of which is electrically and mechanically attached to a respective one of the female contact (18) and the ground contact.

7. The assembly of claim 6, wherein the pair of electrical wires (22, 24) is disposed along the longitudinal axis of the housing (11, 211).

8. The assembly of any preceding claim, wherein the housing (11, 211) has latching ears (52) disposed on external surfaces thereof and securing the connector in the squib socket (300).

Patentansprüche

1. Ausrichtungsfreie Zündkapsel-Anschlußbaugruppe für eine Kraftfahrzeugairbag-Baugruppe, die folgendes umfaßt:

(a) eine Zündkapselbuchse (300), die einen koaxial innerhalb der Buchse angeordneten Steckerkontakt (40) und eine in derselben angeordnete Erdungsfläche (64) hat, und

(b) einen Zündkapselsteckverbinder (10, 210), der ein Gehäuse (11, 211) mit einer Längsachse und einer Spitze (60), die innerhalb der Zündkapselbuchse aufgenommen werden kann, einen innerhalb der Spitze für einen passenden Eingriff mit dem Steckerkontakt (40) angeordneten Buchsenkontakt (18) und einen Erdkontakt (20, 84), der mit der Erdungsfläche (64) der Zündkapselbuchse in Eingriff gebracht werden kann, einschließt, dadurch gekennzeichnet, daß die Erdungsfläche (64) einen ringförmigen Ring innerhalb der Buchse umfaßt, der die Spitze (60) des Steckverbindergehäuses (11, 211) umschließt, und der Erdkontakt des Zündkapselsteckverbinder selbst wenigstens einen elastischen Federarm (56, 86), angeordnet an einer äußeren Seitenfläche der Gehäusespitze, an einer Stelle quer zur Längsachse des Steckverbindergehäuses, umfaßt.

2. Baugruppe nach Anspruch 1, bei welcher der Erdkontakt des Zündkapselsteckverbinder einen wesentlich zylindrischen Korb (84) umfaßt, der eine Vielzahl von Federarmen (86) hat, die mit Abstandsbeziehung angeordnet werden und einen Umfang des Korbs definieren.

3. Baugruppe nach Anspruch 1 oder 2, bei der das Gehäuse (11, 211) ein oberes Gehäuse (12, 212) und ein unteres Gehäuse (14, 214) umfaßt, die aneinander befestigt werden.


5. Baugruppe nach Anspruch 3 oder 4, die einen teilweise zwischen dem oberen Gehäuse (212) und dem unteren Gehäuse (214) angeordneten Nasenkörper (70) einschließt, wobei ein Abschnitt des Nasenkörpers über das Gehäuse hinaus vorsteht und die Spitze umfaßt.


8. Baugruppe nach einem der vorhergehenden Ansprüche, bei der das Gehäuse (11, 211) Einrastösen (52) hat, die an Außenflächen desselben angeordnet werden und den Steckverbinder in der Zündkapselbuchse (300) sichern.

Revendications

1. Assemblage de connecteur d’amorce exempt d’orientation pour un assemblage de coussin d’air pour véhicule à moteur, comprenant

(a) une douille d’amorce (300) comportant un contact mâle (40) agencé coaxialement dans la douille, et une surface de mise à la masse (64) qui y est engenée, et

(b) un connecteur d’amorce (10, 210) englobant un boîtier (11, 211) comportant un axe longitudinal et une pointe (60) pouvant être reçue dans la paroi interne cylindrique de la douille de l’amorce, un contact femelle (18) agencé dans la pointe en vue d’un engagement par accouplement avec le contact mâle (40) et un contact de masse (20, 84) pouvant s’engager dans la surface de mise à la masse (64) de la
douille de l’amorce, caractérisé en ce que

la surface de mise à la masse (64) comprend une bague annulaire dans la douille, entourant la pointe (60) du boîtier du connecteur (11, 211), le contact de masse du connecteur d’amorce comprenant au moins une barre à ressort élastique (56, 86) agencée sur une surface latérale externe de la pointe du boîtier au niveau d’un emplacement transversal à l’axe longitudinal du boîtier du connecteur.

2. Assemblage selon la revendication 1, dans lequel le contact de masse du connecteur d’amorce comprend une cage pratiquement cylindrique (84) comportant plusieurs barres à ressort (86) espacées et définissant une circonférence de ladite cage.

3. Assemblage selon les revendications 1 ou 2, dans lequel le boîtier (11, 211) comprend un boîtier supérieur (12, 212) et un boîtier inférieur (14, 214) qui sont assemblés.

4. Assemblage selon la revendication 3, dans lequel les boîtiers supérieur et inférieur sont assemblés par des moyens de verrouillage (42, 46, 48) formés d’une seule pièce avec les boîtiers supérieur et inférieur.

5. Assemblage selon les revendications 3 ou 4, englobant un corps avant (70) agencé partiellement entre le boîtier supérieur (212) et le boîtier inférieur (214), une partie dudit corps avant débordant au-delà du boîtier et comprenant ladite pointe.

6. Assemblage selon l’une quelconque des revendications précédentes, englobant un bloc de ferrite (16) agencé dans le boîtier (11, 211), ledit bloc de ferrite étant agencé autour d’une partie d’une paire de fils électriques (22, 24), dont chacun est fixé électriquement et mécaniquement à un contact femelle (18) respectif et au contact de masse.

7. Assemblage selon la revendication 6, dans lequel la paire de fils électriques (22, 24) est agencée le long de l’axe longitudinal du boîtier (11, 211).

8. Assemblage selon l’une quelconque des revendications précédentes, dans lequel le boîtier (11, 211) comporte des oreilles de verrouillage (52) agencées sur des surfaces externes correspondantes et fixant le connecteur dans la douille de l’amorce (300).