

Recent Developments in Airbags for Passenger Safety in Automobile Engineering

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Abstract- In order to alleviate the critical injuries due to the car accidents, various types of airbags are used. By using different kinds of airbags, the fatality from car accidents is bating day by day very rapidly. The airbags are the big part of this epoch. An airbag is used to prevent the various injuries such as head, chest, & other severe injuries which are caused by the car collision. The bag is designed in such a way so that it can easily inflate in less than a seconds after the collision. The main purpose of the paper is to evaluate the myriad types of airbags, their functions and application of airbags in the triggering development.

Keywords: Working of airbags, Materials required, Properties of fabrics, Different Types, Recent Developments

1. INTRODUCTION

An airbag is defined as a restraint element which has the ability to activate automatically when the vehicle gets into an accidental incident. If the comparison is made between seat belts and airbags, then airbags play an important role from the safety point of view. There is also the tendency to deactivate the mechanism of airbags by using buttons which are provided underside of the seats or on the passenger side of the dashboard. The position of the buttons is provided at different places in different types of vehicles.

Now, the foreground point is when the airbags came into existence? According to the intermodal surface transportation efficiency act 1991, there was the rule passed in which the airbags must be installed at the driver's position and at the passenger's position. The passenger cars and light duty vehicles have to install the airbags at these jotted down position. In the year of September 1999, the National Highway Traffic Safety Administration found that by using the airbags, it had been saved 4600 lives^{1, 4, and 6}.

Now, the conspicuous point is how do the airbags work? The total of airbag system consist of multiple sensors, a control device and at least one airbag in which sensors are used to sense the jerk or tug and then make the airbag possible to come out. The control devices are used to control the time and speed at which the airbags will come out. In addition to that data from accelerometer, wheel speed sensors and other sources are monitored by the control unit to control the position of the airbags. Each and every airbag is packed and deflated into the compartments that is located or positioned at steering, dashboards,

side windows and roofs. The airbags also contain the initiator and chemical propellants that are used to ignite the propellants to generate the thrust. When the condign conditions have reached, the control devices initiate the initiator which in turn ignite the propellants and engender the gas in the airbags. The gas which is filled in the airbags is nitrogen gas. This whole process takes a scanty time and can be fully inflated thereabouts 30 milliseconds^{2, 3, and 5}. After the use of the airbag, it may be replaced as the full chemical burns to inflate the bags that is why, the airbags are used as single devices or one time use devices. The objective of the paper is to evaluate the different types of airbags, material requirements, and applications of airbags.

2. MATERIALS FOR AIRBAGS

Airbags can be made up of polyesters and nylon. There is the range in case of nylon which comprises of nylon 4.6, nylon 6 and nylon 6.6. The property of the nylon differs from range to range as nylon 6.6 is far better than other forms of nylon in thermal properties, recovery in the elastic property, elongation and moisture contents and density^{14, 15}.

Now, the cardinal point is that which type of fabrics are required for airbags? The fabrics which have a high elongation, high strength, have a good resistance to aging, high resistance which thereabouts 190°C, have a large pliability, have a good resistance to ultraviolet lights should be recommended.

3. DIFFERENT TYPES OF AIRBAGS

After so many researches and developments, there are certain types of airbags have been developed which provides the safety to the passengers focusing to protect all the major parts of the passengers, when the accident occurs. The researches are also going on in the automotive industries to provide as much as possible safety to the passengers^{10, 12, and 13}. There are myraid types of airbags which are used in the modern vehicles to provide protection. These are as follows:

1. Side Airbags

These are provided on both the sides of front and rear of the seats in order to protect the passenger's pelvis.

2. Frontal Airbags

For the purpose of the driver's safety, these are located at the steering wheel and on the dashboard for the passenger's safety. These are used to protect the injuries on head and chest during the accidental incident.

3. Side Curtain Airbags

It is another form of the side airbags. These are deployed from the door and roof of the vehicles and are inflated across the windows in order to save the persons head and upper part of the body from the injury which is caused by broken glass.

4. Knee Airbags

These are the airbags which are installed underside of the steering system in order to protect the knees of the drivers from the high tug or jerk that will be caused by high impact of accidental incidents.

5. Rear Curtain Airbags

These are provided on the vehicle's rear side to protect the heads of those persons who are sat on the rear seats.

6. Rear Center Airbags

It is not so common in all vehicles. Most of the vehicles from Toyota Company have been impied with such kind of airbags which protects the rear seated passenger to avoid injuries causing from one another. It is provided at the center of the back seats.

7. Front Center Airbags

It came into the existence in the year of 2013 by General motors, which uses these type of airbags in their vehicles at the centre between the driver's and passenger's seat in order to protect both of the

persons having collision when side impact is very strong from either of the sides.

8. Seat Cushion Airbags

It also came into existence in the year of 2012, it is provided at front sides of the seats in order to protect the person's pelvis from sliding the underside of the lap belt by lifting up the knees.

9. Seat belt Airbags

These airbags have been developed by Ford, in order to provide safety to back seat passengers.

10. Hood Airbags

It is a latest innovation which has been done by Volvo Company; to protect the pedestrian's head, when collide with the vehicles. The airbag is located at the base of the windshield and emanate, when the collision occurs¹⁶.

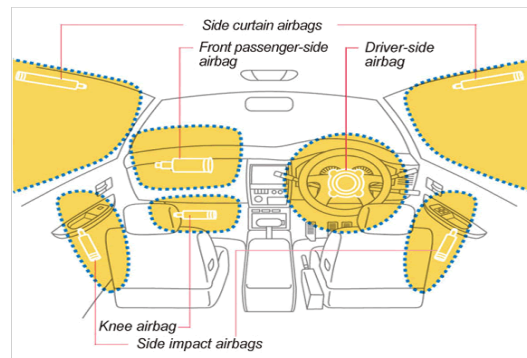


Fig 1- Locations of Airbags

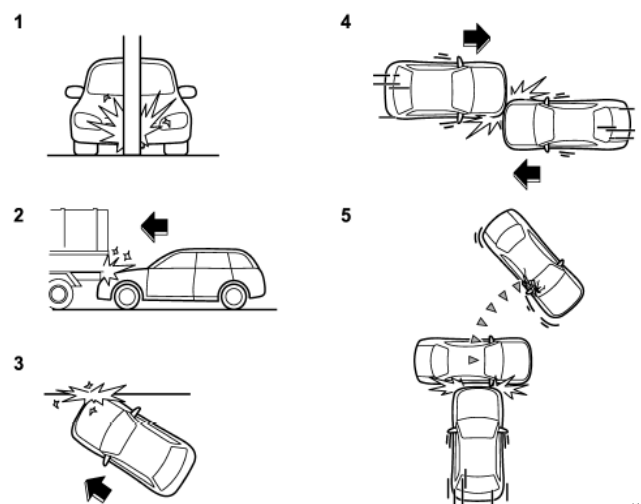


Fig 2- Different Car Accidental Incidents

The figure-1 unravels the different types of airbags which are located at different places in a vehicle to give protection to various difference parts of human body.

The figure-2 divulges the different styles of car collision which might be possible in a daily life of human beings. Due to prevent a person sitting inside the car from severe injuries, the different types of airbags are provided at various places in a vehicle.

Recent Developments in Airbags

- ❖ General Motors was the first company that introduced the first dual depth side airbags for passenger safety. These airbags work depending on the severity of the crashing of the car, position of the seat belt to some distance.
- ❖ BMW Company has also been precosious in the field of airbags. It has already been produced a knee airbags in its 7 series for the driver's knee safety when collision occurs. The reason behind this is that it makes the person to preclude his/her legs due to crash which causes to slide down or forward^{7,8}.
- ❖ There is the great development in the roof type of airbags. The new bag in roof airbags has replaced the pasenger airbags which is located in the intrumental panel to protect passenger. It is used in Citroen Cactus C4 SUV vehicle.



Fig 3- Roof air bag

- ❖ There is the tremendous development in the dual stage airbags which are located at the location of the seat belts and front seats. These are used in less severe as well as high severe accidents. These are also used to prevent child and small adults for getting any injury during collision.

- ❖ There is the great development in the side of the airbags. It comes with three designs in order to protect the passenger. The first design is known as tubular which has a tendency to inflate from roof, curtain design that has a tendency to employ from the roof and another is the airbag design which causes to inflate forward and up.
- ❖ Ford has been introduced the new passenger airbag design on the Ford mustang. When any accident will occur than in the airbags, the inflator fills the bladder and extends it to the entire glovebox outer door panel towards the passnger legs that must have seated in the front. It is thereabouts 65-70% lighter than all the previous airbag system and resulting in more and more legroom for the passenger in the vehicle.
- ❖ In the year of 2013, the General Motors introduced its front center airbags in the Chevrolet Traverse and in Crossover. It has a tendency to deploy from the right side of the driver's seat upto the centre of the vehicle to provide more and more safety to the passengers due to side crush and roll over accidents.
- ❖ In the year of 2011, Ford Motors developed an inflatable seat belts as a part of airbags in order to protect the chest, head, and neck injuries to all those who are seated in the rear seat of the vehicle whether they are child or elder persons^{9, 11}.

4. CONCLUSION & FUTURE SCOPE

As from the above, it is concluded that many manufacturing companies have provided various types of airbags to protect the passengers in the vehicle when any collision or accidental incident occurs. There have been astounding developments in the field of airbags such as development of knee airbags, roof airbags and many more. Many manufacturing companies are working on the further developments in the airbags in order to protect infants whoc are being seated at the front seat or rear seats. Other than that, the work is being carried on in order to have an external airbags on the side of the cars in order to protect the passengers from the side crashes.

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