ISSN: 2321-8169
91 - 97

Human Life Protection by Safety Airbags used in Cars

Rajesh Kamalkishor Mantri
Mechanical Engineering Department
Government Polytechnic, Khamgaon-444303
Maharashtra (India)
Email : rajeshmantri44@gmail.com

Chaitanya Satish Deshpande
Mechanical Engineering Department
Mauli College of Engineering & Technology,
Shegaon-444202 Maharashtra (India)
E-mail: csd94kgn@gmail.com

Abstract— An airbag is a vehicle safety device. It is a type of occupant restraint system that consists of a flexible fabric bag, also known as an airbag cushion. The airbag module is designed to inflate rapidly then quickly deflate during a collision or impact with another object or a sudden deceleration. The purpose of the airbag is to provide occupant protection and restraint during a crash event. The airbag provides an energy absorbing surface between the vehicle's occupant and a steering wheel, instrumental panel, A-B-C- structural body frame pillars, headliner and windshield/windscreen.The present topic is about safety airbags used in cars. No safety device has consumed more attention and resources than the airbag. It is known with high confidence that when a crash occurs, the presence of airbag reduces fatality risk to drivers. Airbags are subject of serious government and industry research . It takes you to the history, development and working aspects of airbag.

Keywords*- airbag, safety in car crash, automobile safety devices*

*****

I. INTRODUCTION

For years, the trusty seat belt provided the sole form of passive restraint in our cars. There were debated about their safety, especially relating to children. But over time, mush of the country adopted mandatory seat-belt laws. Statistics have shown that the use of seat belts has saved thousands of lives that might have been lost in collisions.

Air Bags have been under development for many years. The attraction of a soft pillow to land against in a crash must be very strong – the first patent on an inflatable crash-landing device for airplanes was filed during World War II. In the 1980's the first commercial air bags appeared in automobiles.

Since 1988, all new cars have been required to have air bags on both driver and passenger sides (Light Trucks came under the rule in 1999). To date, Statistics show that air bags reduce the risk of dying in a direct frontal crash by 30 percent. Newer than steering Wheel mounted or Dashboard-mounted bags, but not so widely used, are seat-mounted and door mounted side air-bags. Some experts say that within the next few years, our cars will go from having dual air bags top having six or even eight air bags. Having evoked some of the controversy that surrounded seat-belt use in its early years, air bags are the subject of serious government and industry research and tests.

II. BASICS OF AIRBAGS

Before looking at specifics, let's review our knowledge of the laws of the motion. First, we know that moving objects have momentum (the product of the mass and velocity of an object. Unless an outside force acts on an object, the object will continue to move its present speed and direction. Cars consist of several objects, including the vehicle itself, Loose objects in the car and, of course, passengers. If these objects are not restrained, they will continue moving at whatever speed the car is traveling at, even if the car is stopped by a collision.

Stopping an object's momentum requires force acting over a period of time. When a car crashes, the force required to stop an object is very great because the car's momentum has changed instantly while the passengers' has not much time to work with. The goal of any supplemental restraint system is to help stop the passenger while doing as little damage to him or her as possible.

What an air bag wants to do is to slow the passengers' speed to zero with little or no damage. The constraints that it has to work within are huge. The air bag has the space between the passenger and the steering wheel or dashboard and a fraction of a second to work with. Even that tiny amount of space and time is valuable, however, if the system can slow the passenger evenly rather than forcing an abrupt halt to his or her motion.

As shown in Fig. 1(a), when a body hits the steering wheel directly, the force of this impact is distributed over a small area of the body, resulting in injuries to this area. The area that hits the steering wheel is shown in red.

As shown in Fig. 1(b), when a body is restrained by an airbag, the force of the impact is distributed over a much larger area of the body, resulting in less severe injuries. The area that hits the airbag is shown in orange.

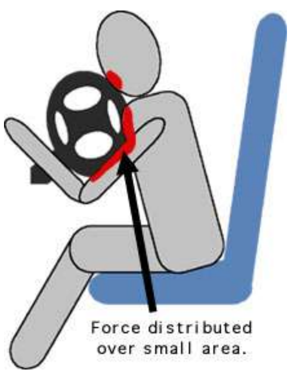


Fig. 1(a)

Fig. 1(b)

III. DEVELOPMENT OF AIRBAGS

The idea of using a rapidly inflating cushion to prevent crash injuries has a long history. The first patent on an inflatable crash-landing device for airplanes was filed during World War II.

Early efforts to adapt the air bag for use in cars bumped up against prohibitive prices and technical hurdles involving the storage and release of compressed gas.

- If there was enough room in a car for a gas canister.
- Whether the gas would remain contained at high pressure for the life of the car.
- How the bag could be made to expand quickly and reliably at a variety of operating temperatures and without emitting an ear-splitting bang.

They needed a way to set off a chemical reaction that would produce the nitrogen that would inflate the bag. Small solid-propellant inflators came to rescue in the 1970's.

In the early days of auto air bags, experts cautioned that the new device was to be used in tandem with the seat belt. Seat belts were still completely necessary because airbags worked only in front-end collisions occurring at more than 6 Kmph. Only Seat belts could help in side swipes and crashes (Although side-mounted air bags are becoming more common now), rear end collisions and secondary impacts. Even as the technology advances, air bags still are only effective when used with a lap/Shoulder seat belt.

IV. MAIN PARTS OF AIRBAGS

There are three parts to an air bag that help to accomplish this activity. They are as follows.

1. Bag
2. Sensor
3. Inflation system

1. BAG

The bag itself is made of a thin, nylon fabric, which is folded into the steering wheel or dashboard or, more recently, the seat or door. The powdery substance released from their sir bag, by the way, is regular cornstarch or talcum powder, which is used by the air bag manufacturers to keep the bags pliable and lubricated while they're in storage.

2. SENSOR

The sensor is the device that tells the bag to inflate. It works with the control module to discriminate between crash and non-crash events. These sensors measure the severity of the impact. Inflation happens when there is a collision force equal to running into a brick wall at 16 to 24 Km per hour. They are setup so that sudden negative acceleration will cause the contacts to close, telling the control module that a crash before airbag deployment.

3. INFLATION SYSTEM

The air bag's inflation system reacts sodium azide (NaN_3) with potassium nitrate (KNO_3) to produce large volume of nitrogen gas. Hot Blasts of the nitrogen inflate the air bag from its storage site up to 322Kmph. A Second later, the gas quickly dissipates through a tiny holes in the bag, thus deflating the bag so you can move.

V. CONSTRUCTION OF AIRBAGS

Airbag are assemblies consisting of the airbag (made of Nylon), inflator modules and sensor housing, electrical connectors (Clock spring), airbag retainer and the cover. The driver's side bag is mounted in the center of the steering wheel as shown in fig. 2.

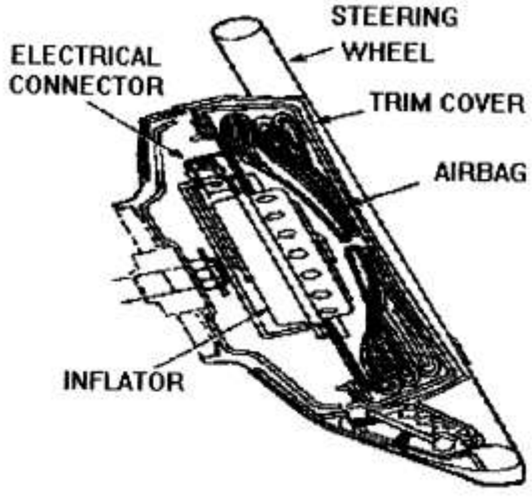


Fig. 2 Driver's Side Bag

VI. TYPES OF SENSORS

1. Mass Type Sensors
2. Roller Type Sensors

The airbag works as an inflatable seatbelt that inflates upon frontal impact from another vehicle. In this new model, the purpose of this inflatable seatbelt is to reduce the strain that is normally placed on the ribcage during a collision. Activation of automotive airbags is triggered by crash sensors (also known as impact sensors) that work to detect frontal impact and trigger a control unit that deploys the airbag to cushion the passenger.

Airbags are designed to deploy in frontal and near-frontal collisions more severe than a threshold defined by the regulations governing vehicle construction in whatever particular market the vehicle is intended for: United States regulations require deployment in crashes at least equivalent in deceleration to a 23 kmph barrier collision, or similarly, striking a parked car of similar size across the full front of each vehicle at about twice the speed.[73] International regulations are performance based, rather than technology-based, so airbag deployment threshold is a function of overall vehicle design.

Unlike crash tests into barriers, real-world crashes typically occur at angles other than directly into the front of the vehicle, and the crash forces usually are not evenly distributed across the front of the vehicle. Consequently, the relative speed between a striking and struck vehicle required to deploy the airbag in a real-world crash can be much higher than an equivalent barrier crash. Because airbag sensors measure deceleration, vehicle speed is not a good indicator of whether an airbag should have deployed. Airbags can deploy due to the vehicle's undercarriage striking a low object protruding above the roadway due to the resulting deceleration.

The airbag sensor is a MEMS accelerometer, which is a small integrated circuit with integrated micro mechanical elements. The microscopic mechanical element moves in response to rapid deceleration, and this motion causes a change in capacitance, which is detected by the electronics on the chip that then sends a signal to fire the airbag. The most common MEMS accelerometer in use is the ADXL-50 by Analog Devices, but there are other MEMS manufacturers as well. Initial attempts using mercury switches did not work well. Before MEMS, the primary system used to deploy airbags was called a "rolamite". A rolamite is a mechanical device, consisting of a roller suspended within a tensioned band. As a result of the particular geometry and material properties used, the roller is free to translate with little friction or hysteresis. This device was developed at Sandia National Laboratories. The rolamite and similar macro-mechanical devices were used in airbags until the mid-1990s when they were universally replaced with MEMS.

Nearly all airbags are designed to automatically deploy in the event of a vehicle fire when temperatures reach 150-200 °C (300-400 °F). This safety feature, often termed auto-ignition, helps to ensure that such temperatures do not cause an explosion of the entire airbag module.

Today, airbag triggering algorithms are becoming much more complex. They try to reduce unnecessary deployments and to adapt the deployment speed to the crash conditions. The algorithms are considered valuable intellectual property. Experimental algorithms may take into account such factors as the weight of the occupant, the seat location, seatbelt use, and even attempt to determine if a baby seat is present.

1. MASS TYPE SENSOR

An impact sensor is normally fitted to the front of the vehicle as this is where a collision is likely to occur. The sensor is positioned inside the engine and a similar safety sensor is located inside the passenger zone to the vehicle. This safety sensor is required to measure the intensity of the collision to determine whether the impact is over a certain threshold to justify release of an airbag. Both types of sensors (termed inertia sensors) work on the principle of detecting a decrease in acceleration of a moving vehicle and generate an electrical impulse. Fig. 1 is a schematic diagram of an inertial sensor. During a collision with another moving vehicle, the sensing mass is forced forward into the gold-plated contacts as a result of change in the state of motion. Following movement of this metal ball into the contacts, this metal mass makes contact with electrical terminals at either side of the metal ball which alerts the central unit to a collision (i.e., the electrical contact completes the circuit).

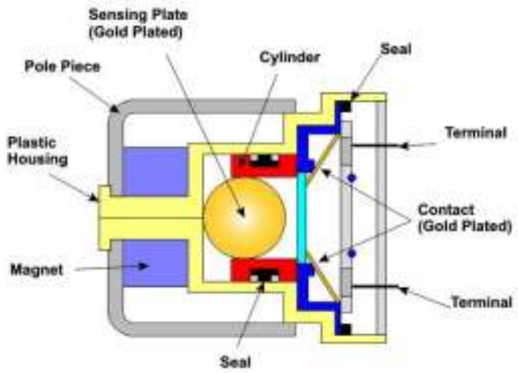


Fig. 3 Mass Type Sensor

2. ROLLER TYPE SENSOR

The roller-type sensor involves a weight connected to a coil spring component. Like the mass-type sensor, during impact with an oncoming vehicle, the metal weight is forced forward which alters the tension on the coil spring to manipulate the electrical circuit that closes off the sensor contact. It is important to note that the impact and safety sensors must activate and close off at the same time to allow for deployment of the airbag (Figure 3).

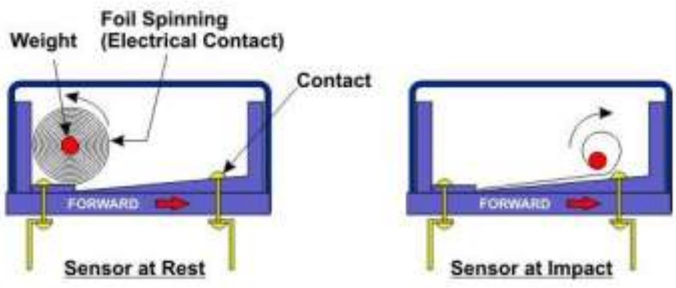


Fig. 4 Roller Type Sensor

INFLATOR ASSEMBLY

This is a diagram of a typical inflator assembly behind the steering wheel. When the control Module activates the airbag assembly, an electric current is sent to the detonator, which ignites the sodium azide pellets. When it burns, it releases nitrogen gas very quickly and in large quantities. This is what inflates the airbag.

Sodium Azide is Rocket fuel. Sodium azide is a solid propellant with a very high gas generation ratio. It is very stable in this application. When Sodium azide burns, its major product is nitrogen gas, which makes up around 78% of the Earth’s atmosphere. One of the other by-products is sodium hydroxide. This is commonly known as Lye, which is a caustic compound. The quantities produced are very small and present a very small risk of burns. The white powder residue seen after inflation is common cornstarch, used as lubricant for expansion of the airbag. Testing is underway with inflators that release argon gas.

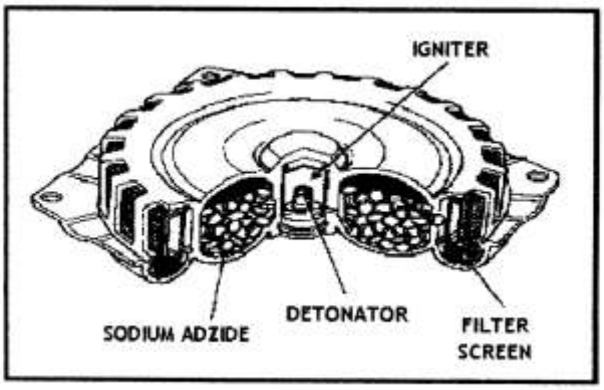


Fig. 5 Inflator Assembly

VII. WORKING OF AIRBAGS

Air Bags are designed to inflate in frontal or frontal-angle impacts in which the car strikes an immovable object at more than about 16 Kilometers per hour or another car at twice that speed. After a collision, sensors sense an electric current to an igniter system or, in some cases, to the computerized control unit. This unit evaluates the situation and then sends an electrical impulse to the igniter system. The electric current heats a filament (wire), which then ignites a capsule. The ignited capsule supplies the heat to ignite gas-generating pellets. In most systems, the pellets are made of sodium azide and produce nitrogen gas when they burn. In other systems, pressurized argon gas is used instead. The gas then expands quickly and inflates the airbag, which then breaks through a plastic cover in the steering wheel or, the dashboard on the passenger side. The whole process takes about 0.1 second from the exact moment the crash is detected. The air bag starts to deflate immediately, venting the harmless gas through holes in the back of the bag of the through the fabric itself.

The airbags in the vehicle are controlled by a central Airbag control unit (ACU), a specific type of ECU. The ACU monitors a number of related sensors within the vehicle, including accelerometers, impact sensors, side (door) pressure sensors, wheel speed sensors, gyroscopes, brake pressure sensors and seat occupancy sensors. The bag itself and its inflation mechanism is concealed within the steering wheel boss (for the driver), or the dashboard (for the front passenger), behind plastic flaps or doors which are designed to "tear open" under the force of the bag inflating. Once the requisite 'threshold' has been reached or exceeded, the airbag control unit will trigger the ignition of a gas generator propellant to rapidly inflate a fabric bag. As the vehicle occupant collides with and squeezes the bag, the gas escapes in a controlled manner through small vent holes. The airbag's volume and the size of the vents in the bag are tailored to each vehicle type, to spread out the deceleration of (and thus force experienced by) the occupant over time and over the occupant's body, compared to a seat belt alone.

The signals from the various sensors are fed into the Airbag control unit, which determines from them the angle of impact, the severity, or force of the crash, along with other variables. Depending on the result of these calculations, the ACU may also deploy various additional restraint devices, such as seat belt pre-tensioners, and/or airbags (including frontal bags for driver and front passenger, along with seat-mounted side bags, and "curtain" airbags which cover the side glass). Each restraint device is typically activated with one or more pyrotechnic devices, commonly called an initiator or electric match. The electric match, which consists of an electrical conductor wrapped in a combustible material, activates with a current pulse between 1 to 3 amperes in less than 2 milliseconds. When the conductor becomes hot enough, it ignites the combustible material, which initiates the gas generator. In a seat belt pre-tensioner, this hot gas is used to drive a piston that pulls the slack out of the seat belt. In an airbag, the initiator is used to ignite solid propellant inside the airbag inflator. The burning propellant generates inert gas which rapidly inflates the airbag in approximately 20 to 30 milliseconds. An airbag must inflate quickly in order to be fully inflated by the time the forward-traveling occupant reaches its outer surface. Typically, the decision to deploy an airbag in a frontal crash is made within 15 to 30 milliseconds after the onset of the crash, and both the driver and passenger airbags are fully inflated within approximately 60-80 milliseconds after the first moment of vehicle contact. If an airbag deploys too late or too slowly, the risk of occupant injury from contact with the inflating airbag may increase. Since more distance typically exists between the passenger and the instrument panel, the passenger airbag is larger and requires more gas to fill it.

VIII. CHEMISTRY BEHIND AIRBAGS

Older airbag systems contained a mixture of sodium azide (NaN_3), KNO_3 and SiO_2. A typical driver-side airbag contains approximately 50-80 g of NaN_3, with the larger passenger-side airbag containing about 250 g. Within about 40 milliseconds of impact, all these components react in three separate reactions that produce nitrogen gas. The reactions, in order, are as follows.

(1) $2\ NaN_3 \rightarrow 2\ Na + 3\ N_2\ (g)$

(2) $10\ Na + 2\ KNO_3 \rightarrow K_2O + 5\ Na_2O + N_2\ (g)$

(3) $K_2O + Na_2O + 2\ SiO_2 \rightarrow K_2O_3Si + Na_2O_3Si$ (silicate glass)

The first reaction is the decomposition of NaN_3 under high temperature conditions using an electric impulse. This impulse generates to 300 °C temperatures required for the decomposition of the NaN_3 which produces Na metal and N_2 gas. Since Na metal is highly reactive, the KNO_3 and SiO_2 react and remove it, in turn producing more N_2 gas. The second reaction shows just that. The reason that KNO_3 is used rather than something like $NaNO_3$ is because it is less hygroscopic. It is very important that the materials used in this reaction are not hygroscopic because absorbed moisture can de-sensitize the system and cause the reaction to fail. The final reaction is used to eliminate the K_2O and Na_2O produced in the previous reactions because the first-period metal oxides are highly reactive. These products react with SiO_2 to produce a silicate glass which is a harmless and stable compound.

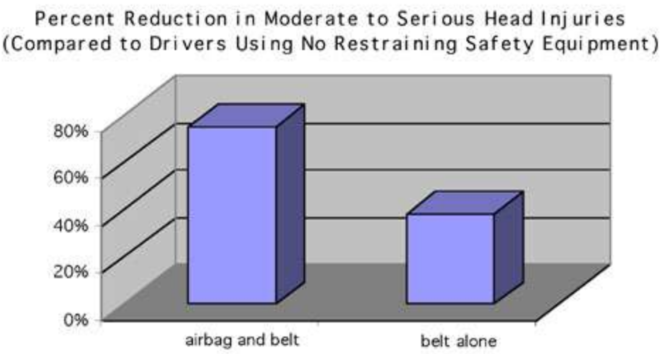
According to a patent, the particle size of the sodium azide, potassium nitrate, and silicon dioxide are important. The NaN_3 and KNO_3 must be between 10 and 20 µm, while the SiO_2 must be between 5 and 10 µm.

There are ongoing efforts to find alternative compounds that can be used in airbags which have less toxic byproducts. In a journal article by Akiyoshi et. Al., it was found that for the reaction of the Sr complex nitrate, $(Sr(NH_2NHCONHNH_2)\cdot(NO_3)_2$ of carbohydrazide (SrCDH) with various oxidizing agents resulted in the evolution of N_2 and CO_2 gases. Using $KBrO_3$ as the oxidizing agent resulted in the most vigorous reaction as well as the lowest initial temperature of reaction. The N_2 and CO_2 gases evolved made up 99% of all gases evolved. Nearly all the starting materials won't decompose until reaching temperatures of 500 °C or higher so this could be a viable option as an air bag gas generator. In a patent containing another plausible alternative to NaN_3 driven airbags, the gas generating materials involved the use of guanidine nitrate, 5-aminotetrazole, bitetrazole dehydrate, nitroimidazole and basic copper nitrate. It was found that these non-azide reagents allowed for a less toxic, lower combustion temperature reaction and more easily disposable air bag inflation system.

Front airbags normally do not protect the occupants during side, rear, or rollover accidents. Since airbags deploy only once and deflate quickly after the initial impact, they will not be beneficial during a subsequent collision. Safety belts help reduce the risk of injury in many types of crashes. They help to properly position occupants to maximize the airbag's benefits and they help restrain occupants during the initial and any following collisions.

In vehicles equipped with a rollover sensing system, accelerometers and gyroscopes are used to sense the onset of a rollover event. If a rollover event is determined to be imminent, side-curtain airbags are deployed to help protect the occupant from contact with the side of the vehicle interior, and also to help prevent occupant ejection as the vehicle rolls over.

The following graph shows the role of airbags in effectively saving the human life as compared to other safety devices fitted in the car.



Graph 1

IX. WHAT HAPPENS DURING INFLATION

When the frontal airbags are to deploy, a signal is sent to the inflator unit within the airbag control unit. An igniter starts a rapid chemical reaction generating primarily nitrogen gas (N_2) to fill the airbag making it deploy through the module cover. Some airbag technologies use compressed nitrogen or argon gas with a pyrotechnic operated valve ("hybrid gas generator"), while other technologies use various energetic propellants. Although propellants containing the highly toxic sodium azide (NaN_3) were common in early inflator designs, little to no toxic sodium azide has been found on used airbags.

The azide-containing pyrotechnic gas generators contain a substantial amount of the propellant. The driver-side airbag would contain a canister containing about 50 grams of sodium azide. The passenger side container holds about 200 grams of sodium azide.[75]

The alternative propellants may incorporate, for example, a combination of nitroguanidine, phase-stabilized ammonium nitrate (NH_4NO_3) or other nonmetallic oxidizer, and a nitrogen-rich fuel different from azide (e.g. tetrazoles, triazoles, and their salts). The burn rate modifiers in the mixture may be an alkaline metal nitrate (NO_3-) or nitrite (NO_2-),dicyanamide or its salts, sodium borohydride ($NaBH_4$), etc. The coolants and slag formers may be e.g. clay, silica, alumina, glass, etc. Other alternatives are e.g. nitrocellulose based propellants (which have high gas yield but bad storage stability, and their oxygen balance requires secondary oxidation of the reaction products to avoid buildup of carbon monoxide), or high-oxygen nitrogen-free organic compounds with inorganic oxidizers (e.g., di or tricarboxylic acids with chlorates (ClO_3-) or perchlorates (ClO_4-) and eventually metallic oxides; the nitrogen-free formulation avoids formation of toxic nitrogen oxides).

From the onset of the crash, the entire deployment and inflation process is about 0.04 seconds. Because vehicles change speed so quickly in a crash, airbags must inflate rapidly to reduce the risk of the occupant hitting the vehicle's interior.

X. POST DEPLOYMENT OF AIRBAGS

A chemical reaction produces a burst of nitrogen to inflate the bag. Once an airbag deploys, deflation begins immediately as the gas escapes through vent(s) in the fabric (or, as it's sometimes called, the cushion) and cools. Deployment is frequently accompanied by the release of dust-like particles, and gases in the vehicle's interior (called effluent). Most of this dust consists of cornstarch, french chalk, or talcum, which are used to lubricate the airbag during deployment.

Newer designs produce effluent primarily consisting of harmless talcum powder/cornstarch and nitrogen gas. In older designs using an azide-based propellant (usually NaN_3), varying amounts of sodium hydroxide nearly always are initially present. In small amounts this chemical can cause minor irritation to the eyes and/or open wounds; however, with exposure to air, it quickly turns into sodium bicarbonate (baking soda). However, this transformation is not 100% complete, and invariably leaves residual amounts of hydroxide ion from NaOH. Depending on the type of airbag system, potassium chloride may also be present.

For most people, the only effect the dust may produce is some minor irritation of the throat and eyes. Generally, minor irritations only occur when the occupant remains in the vehicle for many minutes with the windows closed and no ventilation. However, some people with asthma may develop a potentially lethal asthmatic attack from inhaling the dust. Because of the airbag exit flap design of the steering wheel boss and dashboard panel, these items are not designed to be recoverable if an airbag deploys, meaning that they have to be replaced if the vehicle has not been written off in an accident. Moreover, the dust-like particles and gases can cause irreparable cosmetic damage to the dashboard and upholstery, meaning that minor collisions which result in the deployment of airbags can be costly accidents, even if there are no injuries and there is only minor damage to the vehicle structure.

XI. MODERN TYPES OF AIRBAGS

1. Curtain Airbags

Curtain airbags are airbags that inflate in front of vehicle windows to provide passengers better head and neck protection. The curtain airbags are part of new rollover protection system. Most equipped cars will have vertically inflating curtain airbags in the headliner trim just above the windows, while some will have them inflate horizontally from the side pillar between the doors. In some cases, curtain airbags will deploy in a fraction of a second.

2. Head Thorax Bags

The Head-Thorax Side-Impact Airbag has an extension from the regular Thorax Bag that protects the head. It was introduced in 1998 and developed in cooperation with Ford and Renault.

3. Inflatable Tubular Structure (I.T.S.)

The Inflatable Tubular Structure (ITS), the world's first airbag for head protection, was introduced on BMW cars. It consists of a unique nylon tube, installed in the head-liner above the frontal doors that inflates to a diameter of about 15 cms (5 inches).

4. Knee Airbags

The second driver's side and separate knee airbag was used in USA first. The airbag is located beneath the steering wheel for protection of knees.

5. Rear Curtain Airbag

In 2008, the new Toyota iQ Microcar featured the first production rear curtain shield airbag to protect the rear occupants' heads in the event of a rear end impact.

6. Seat Cushion Airbag

Another feature of the Toyota iQ was a seat cushion airbag in the passenger seat. This is to prevent the pelvis from diving below the lap belt during a frontal impact or submarining. Later Toyota models such as the Yaris added the feature to the driver's seat as well.

7. Seat Belt Airbag

The seat belt airbag is designed to better distributed the forces experienced by a buckled person in a crash by means of increased seat belt area. This is done to reduce possible injuries to the rib cage or chest of the belt wearer.

XII. FUTURE OF AIRBAGS

1. Smart Systems

The smart airbag of the future is not just the airbag, but also a redesign of the components in the current airbag system. Features includes Weight Sensors for the passenger seat to classify the weight and to determine what type of occupant is in the seat, i.e. adult or child.

2. Infrared Occupant Detection

This system will use infrared beams (just like in your TV remote control) to detect the distance the passenger is from the airbag and adapt the force of deployment accordingly.

3. Capacitive Reflective Occupant Sensing

These sensors will be located in the seat backs and in the dash to identify the distance you and or your passengers are from the dashboard. These sensors will be able to discriminate between a human occupant and inanimate objects like your groceries. This alone will save thousands of dollars in the cases where the driver is the only occupant in the front seat.

4. Updated sensors

The updated sensors will have the capabilities of deploying the seatbelt pretensioners faster, so in a crash situation you will be in the best position to benefit from the airbag deployment.

5. Centralized Electronic Control Unit

The new control units will be able to use all the input from the new sensor technology and through new software deploy what you need and when you need it. (Smart Airbag as shown in Fig. 6 below).

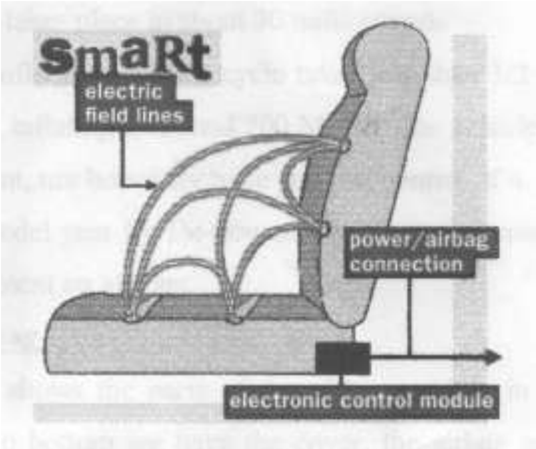


Fig. 6 Smart Airbag

XIII. AIRBAG CHECKS

When you get in your vehicle and turn the key, look at the dash to find your airbag or SRS light. It should come on for 7-10 seconds and then go out. This tells you all is well with the airbag system.

- If the light does not come on, have it checked. After all, it could just be a burnt out Light bulb
- If the light does not go off after this period (usually 7-10 seconds) there is a problem
- If the Light comes on while you are driving, it also needs attention.

In addition to the front airbags, the car companies are putting airbags in the doors for side impacts that are not covered by the primary airbags. They are putting them in the seats for the drivers and rear passengers as well. This increases the cost6 as well as the complexity of the systems.

Since 1990, National Highway Traffic Safety Administration, which is responsible for the Vehicle safety rules and statistics relating to vehicles, found that of 19 drivers killed by airbags, only five of them were wearing seat belts and two of them were determined to be unconscious before the airbag deployed.

XIV. MAINTENANCE

Inadvertent airbag deployment while the vehicle is being serviced can result in severe injury, and an improperly installed or defective airbag unit may not operate or perform as intended. Some countries impose restrictions on the sale, transport, handling, and service of airbags and system components. In Germany, airbags are regulated as harmful explosives; only mechanics with special training are allowed to service airbag systems.

Some automakers (such as Mercedes-Benz) call for the replacement of undeployed airbags after a certain period of time to ensure their reliability in an accident. One example is the 1992 S500, which has an expiry date sticker attached to the door pillar. Some Škoda vehicles indicate an expiry date of 14 years from the date of manufacture. In this case, replacement would be uneconomic as the car would have negligible value at 14 years old, far less than the cost of fitting new airbags. Volvo, on the other hand, has stated "airbags do not require replacement during the lifetime of the vehicle," though this cannot be taken as a guarantee on the device.

XV. LIMITATIONS OF AIRBAGS

1. **Potential Injury**

The biggest negative to airbags is that, though they are designed to protect, deploying airbags can actually injure passengers in some situations. The impact of an airbag can hurt a passenger who is improperly positioned. Deployment injuries can be most harmful to children and infants. Types of injuries from airbags include chest injuries, concussions and whiplash. Safety advocates recommend against individuals under 12 riding in a front seat with airbags. Also, drivers are cautioned against placing rear-facing infant seats in the front seat with an airbag. For adults, sit at least 10 to 12 inches away from the airbag to minimize the impact if it should be deployed. It's very important to use seat belts along with airbags. This helps cut down on potential airbag injuries for both drivers and passengers.

2. **Resetting Airbags**

After airbags have been deployed, they may be difficult to re-position for the next deployment. You may spend substantial money at a shop getting passenger airbags reset. Again, if there is only one occupant in the car, a multiple airbag deployment can be a waste of money.

XVI. CONCLUSION

The air bags are of greater importance in today's vehicles since safety of human life is of prior importance. Since the count of automobiles is increasing tremendously on our roads, the probability of accidents is also more. So far a safe riding and for saving the precious life the safety bags must be implemented. Today it is the prevail age of the high class people who own high priced cars. Let's hope every automobile manufacturers implement the same since safety for life is inevitable.

XVII. REFERENCES

[1] "The History of Airbags". About.com- New York Times Company. Retrieved 16 March2014.
[2] "Statistical Breakdown of Air Bag Fatalities". National Highway Traffic Safety Administration. Archived from the original on 26 February 2008. Retrieved 16 March 2014.
[3] "Safety Cushion for Automotive Vehicles", United States Patent and Trademark Office
[4] Leonard Evans, "Airbag benefits, Airbag Costs", Journal of Science Servicing Society,2003
[5] Website on Airbag http://auto.howstuffworks.com/car-driving-safety/safety-regulatory-devices/airbag.htm
[6] Website on Airbag www.scienceservicinsociety.com
[7] Frontal Crash Technologies of 90 's Feb 1991 SAE SP 852 page no 159
[8] Protection Seat & Airbags, March 1993, SAE SP 947, SAE 930645, page no 85