

Chronological Listing of Major Fuel System Integrity Patents

Patent No.	Date Issued	Inventors	Assignee	Description
2,079,598	05/11/37	Robert Berkowitz	Metal Hose & Tubing Co. Inc.	Flexible multi-ply gasoline hose with a gasoline-proof cellophane sheath over a metallic liner, encased in rubber with a durable fabric outer coating.
2,214,330	09/10/40	Arthur James Henderson, Cecil Arthur Forecast and Arthur James Berry Coates		Sheet metal fuel tank with pleated sides to withstand impact without rupturing, especially when used as an inner shell of tank, between which and the outer metal shell is a layer of structurally continuous rubber compound.
2,316,116	04/06/43	William G. Thompson and Bartlett M. Kerr	J. I. Case Company	Fuel tank for vehicles with an auxiliary fuel compartment, constructed with a minimum of seams to prevent splitting from vibration or impact.
2,367,953	01/23/45	Joseph Lloyd	J. Mandleberg & Company Limited	Multi-ply bias fabric container, lined with synthetic rubber, for use in a metal fuel tank frame to protect against leakage of fuel.
2,530,819	11/21/50	Benson Hamlin	Jolene Corporation	Saddle tank designed to be lightweight yet able to absorb and distribute impact shocks without puncturing or rupture.
2,730,133	01/10/56	Wilfrid Holland-Bowyer and James Henry Woodward	Dunlop Rubber Company Limited	Reinforced fireproof hose for fuels or other inflammable liquids, with a natural rubber lining tube encased in layers of steel, asbestos braid, and fire-resistant neoprene, reinforced with steel wire coil and covered with an outer layer of neoprene.
2,736,356	02/28/56	Edward E. Bender, Clifford Oates, Jr. and Walter J. Phane	½ to Chance Vought Aircraft, Incorporated and ½ to The Goodyear Tire & Rubber Company	Bladder-type fuel cell for collapsible fuel tanks, constructed of neoprene or synthetic rubber-coated impervious fabric that is flexible yet non-wrinkling, with a pressure cell to force fuel from the tank through the appropriate outlet.
2,779,498	01/29/57	Edward N. Cole and Edward J. Naudzius	General Motors Corporation	Fuel tank with an attachable/detachable tubular filling spout in which the filler tube is telescopically arranged with respect to the and sealed to the inlet tube by means of an annular ring of plastic which is resistant to the chemical action of the fluid to be placed in the tank.

Patent No.	Date Issued	Inventors	Assignee	Description
3,014,730	12/26/61	Edward N. Cole	General Motors Corporation	Fuel tank installation for rear engine-mounted vehicles that protects the tank from external damage and from engine heat and isolates the passenger compartment from fumes and possible fire in the event of tank rupture.
3,026,070	03/20/62	Robert W. Sutton and John T. Reynolds	The Goodyear Tire & Rubber Company	Fuel tank fitting that positions a flexible fuel container in a supporting structure but releases it upon predetermined stress or impact to prevent fuel spill that could cause fire or explosion.
3,129,014	04/14/64	Cyril Paul Hutchinson and John L. Eberly	The Firestone Tire & Rubber Company	Impact-resistant polyurethane fuel tank, which may be reinforced with a layer or layers of fabric or film.
3,347,800	07/24/73	Clare Kenneth Viland		Fuel tank assembly with a flexible rubber inner tank that protects against leaks if the outer metal tank is ruptured and acts as a diaphragm or "floating roof" over the surface of the fuel to prevent evaporation and release of vapors into the environment.
3,426,937	02/11/69	Antonio F. Boschi and Aldo Valentinotti	Pirelli S.p.A.	Impact-resistant fuel tank having a flexible inner lining of rubber or similar material within a non-airtight rigid casing, with the lining walls sufficiently thick so as not to collapse when emptied of fuel.
3,561,639	02/09/71	Donn W. Allen		Fuel cell consisting of an open-celled foam block wrapped in ballistic nylon and elastomer-coated to form a fluid-tight bladder, offering improved sealing, strength-to-weight ratios, and resistance to shear and tension.
3,602,660	08/31/71	Russell L. Eslinger	Triwees Products, Inc.	Collision responsive switch for automobiles that automatically disconnects the battery from the electrical system to prevent post-crash ignition of spilled fuel.
3,610,263	10/05/71	Gary Alan Walters		Ball valve assembly to prevent fuel from escaping through the filler pipe if the vehicle is overturned.
3,620,198	11/16/71	Werner Breitschwerdt and	Daimler-Benz	Collision-activated cutoff valve for fuel feedline.

		Rudolf Andres	Aktiengesellschaft	
Patent No.	Date Issued	Inventors	Assignee	Description
3,621,163	11/16/71	Arthur A. Hitchcock	A. C. B. Corporation	Inertia switch for automobiles that can trigger safety devices, such as a fire extinguisher, in the event of a major accident.
3,650,431	03/21/72	Dan F. Stewart	Phillips Petroleum Company	Self-supporting bulked or textured filamentary plastic material to fill interior of fuel tank, reducing sloshing, vapor buildup, and explosion hazards.
3,661,419	05/09/72	Rakuzo Mitamura, Masatoshi Yamaya and Masakatsu Suzuki	Mitsubishi Jidosha Kogyo Kabushiki Kaisha	Automobile rear body construction utilizing a back wall and extended floor plate with a seal over the fuel tank mounting to direct spilled gasoline outwardly below the trunk space in the event of collision and tank rupture.
3,804,292	04/16/74	Carlo Chiti		Fire-preventing multi-chambered fuel tank, with fuel chambers adjacent to chambers containing a halogen or other fluid such that the mixture that results from tank rupture is nonflammable.
3,830,261	08/20/74	Marvin S. Hochberg, Erwin K. Welhart and James H. Pousson	McDonnell Douglas Corporation	Self-sealing fuel line with a braided fibrous over-wrap or layer of foam bonded to a sealant layer that expands upon contact with fuel, sealing any punctures created by a penetrating projectile.
3,880,217	04/29/75	William Musyt and James D. Tremelin	The Goodyear Tire & Rubber Company	Flexible, rupture-resistant rubberized fabric fuel cell that reduces loss of fuel in the event of a collision.
3,896,964	07/29/75	Atsuo Takei, Isao Nagaoka and Shozo Tsunoda	Bridgestone Tire Company Limited	Impact-resistant, open cell foam-filled fuel tank with a suction pipe extending vertically through the center so that less fuel is trapped in the foam body and the frequency of refilling in auto races is reduced.
3,912,107	10/14/75	Bernard Baumann	Cegedur Societe de Transformation de l'Aluminium Pechiney	Composite fuel tank having a baffle and composed of a metal outer wall, a plastic inner wall, and a core of plastic foam between the walls.
3,963,055	06/15/76	John DeRosa		Self-sealing fuel line with intermittent rings of a soft ductile material that, if the line is ruptured, contract to close off an inner seal tube and

Patent No.	Date Issued	Inventors	Assignee	Description
				prevent further flow of fuel.
3,995,710	12/07/76	Louis B. Courtot	The Weatherhead Company	Fuel line valve that prevents fuel flow from the tank to the engine if the vehicle is tilted or overturned.
3,996,951	12/14/76	Erwin W. Parr and Timothy B. Brandt	Parr Manufacturing Inc.	Gravity-actuated ball valve for the fuel tank vapor vent line that closes if the vehicle overturns or is tilted to a predetermined degree, preventing fuel leaks.
4,041,967	08/16/77	Tsuneo Tsukisaka	Honda Giken Kogyo Kabushiki Kaisha	Ball valve apparatus for motorcycles that automatically stops fuel flow between the fuel tank and the float chamber of the carburetor if the vehicle overturns, replacing the manually operated stopcock customarily used in such vehicles.
4,115,616	09/19/78	Roger M. Heitz and Franklin Hill	The United States of America as represented by the Secretary of the Air Force	Self-sealing multi-laminate fuel line composed of two plastic layers sandwiching a precompressed, fuel-sensitive foam layer.
4,137,889	02/06/79	Antonio Nigra	Gilardini S.p.A.	Fuel diaphragm pump with shut-off valve that prevents fuel flow if vehicle overturns.
4,162,021	07/24/79	Billy G. Crute	Stant Manufacturing Company, Inc.	Previous version of 4,716,920.
4,181,157	01/01/80	Douglas A. DeCamp	Flexfab, Inc.	Fire sleeving made of flame-resistant silicone polymer coated and impregnated glass fiber woven sheet, designed to protect fuel lines and hydraulic lines from extreme temperatures and flame impingement.
4,186,778	02/05/80	Richard D. Carey	Dayco Corporation	Hose constructed primarily of combustible polymer but with an integral fire extinguishant activated by exposure to combustion temperatures.
4,259,989	04/07/81	James M. Lalikos, Chester T. Gazda and Lawrence O'Meila	Titeflex Corporation	Previous version of 4,675,221.

4,269,213	05/26/81	Michiaki Sasaki	Nissan Motor Company, Limited	Ball valve that interrupts fuel flow if vehicle is tilted or overturned.
Patent No.	Date Issued	Inventors	Assignee	Description
4,275,753	06/30/81	Robert J. Williams		Fuel line cut-off switch with a device for collapsing a portion of the fuel line to prevent fuel flow once the switch is tilted.
4,294,279	10/13/81	Harold W. G. Wyeth	The Secretary of State for Defence in Her Britannic Majesty's Government of the United Kingdom of Great Britain and Northern Ireland	Fuel tank with separate impermeably walled cells connected to closing valves and containing fire-protective reticulated structure, such as ester foam, for prevention of fuel loss and fuel-fed fire if tank ruptures.
4,304,274	12/08/81	Roger Villette		Vehicle tank security device that automatically closes tank valves when the tank is being filled or emptied and the vehicle experiences sudden movement or impact.
4,330,017	05/18/82	Seikoh Satoh and Tadashi Suzuki	Nissan Motor Company, Limited and Togawa Rubber Manufacturing Company, Limited	Hose for fuel line comprising a two-ply rubber tube covered with a reinforcing fiber layer and a protective rubber outer layer, which resists mechanical stress and provides protection against sour gasoline and extreme temperatures.
4,378,815	04/05/83	Haruo Mochida and Michiaki Sasaki	Nissan Motor Co., Ltd.	Fuel line pressure control device with a fluid discharge prevention mechanism in case of a rollover.
4,404,983	09/20/83	Dieter Scheurenbrand and Einhard Kleinschmit	Daimler-Benz Aktiengesellschaft	Fuel tank composed of synthetic resinous material with fuel line connector that will seal off the opening in the event of excessive heat or fire.
4,453,564	06/12/84	Giovanni Bergesio	Fiat Auto S.p.A.	Plastic fuel tank with an inner wall structure that prevents fuel from collecting at the periphery during ordinary maneuvering of the vehicle.
4,501,374	02/26/85	S. Harry Robertson		Fuel tank with check valve preventing fuel from escaping through the filler opening if the filler pipe or cap is removed in a collision.

4,570,657	02/18/86	Russell L. Rogers	Aeroquip Corporation	Fuel tank vent valve with a gravity operated lock mechanism that prevents fluid loss if vehicle is overturned.
Patent No.	Date Issued	Inventors	Assignee	Description
4,615,455	10/07/86	Horace A. Tansill		Explosion-resistant fuel tank device utilizing a compressible resilient structure such as a sponge or honeycomb within a conventional metal tank, with a means for compressing the structure to force out fuel to the engine.
4,675,221	06/23/87	James M. Lalikos, Chester T. Gazda and Lawrence O'Melia	Titeflex Corporation	Stainless steel wire mesh fire sleeve for airplane fuel hose, to trap ablative particles that flake from hose when exposed to fire and to protect hose from structural damage.
4,679,599	07/14/87	Mark A. Newberry and Dennis C. Kemper	The Gates Rubber Company	Fuel hose with stretchable elastomer tubing sandwiching a twined reinforcement layer that provides circumferential strength but breaks if the hose is stretched, so that the hose will not rupture or disconnect.
4,696,409	09/29/87	Robert M. Vize	Caterpillar Inc.	Vented fuel tank cap assembly that prevents fuel flow through vent valve if vehicle is tilted or overturned.
4,716,920	01/05/88	Billy G. Crute	Stant Inc.	Fuel tank cap with valve mechanism that closes tank vent when vehicle is overturned, preventing fuel leakage through the cap.
4,758,455	07/19/88	Larry J. Campbell and Joseph M. Concaugh	Handy & Harman Automotive Group Inc.	Composite fuel and vapor tube with a thin nylon liner overlaid with a metal strip and a polyethylene jacket, for increased resistance to heat, abrasion, and various fuels.
4,764,408	08/16/88	Donald R. Stedman and Robert Frankowiak	Foamade Industries, Inc.	Fuel tank baffle made of cellular plastic foam that can be tightly compressed into a long strip surrounded by soluble casing and inserted through the filler neck, where it expands to fill tank entirely and prevents spurting of fuel if tank is ruptured.
4,852,758	08/01/89	Kalman Kormendi, Dieter Lampart, Fritz Mannherz, Dieter Scheurenbrand	Schmalbach-Lubeca AG	Plastic fuel tank wholly containing a smaller collecting tank that assists in efficient fuel delivery to engine.

4,887,647	12/19/89	Ichiro Igarashi, Hiroaki Ito and Kazuhiko Nishimura	Tokai Rubber Industries, Ltd.	Rubber fuel hose with inner fluoro-rubber layer that resists deterioration and provides improved bond with outside layer.
Patent No.	Date Issued	Inventors	Assignee	Description
4,905,726	03/06/90	Joji Kasugai and Norikazu Hosokawa	Toyoda Gosei Co., Ltd.	Interception valve for upper opening of fuel tank that closes in the event of rising fuel level or vehicle rollover, preventing fuel flow.
4,913,303	04/03/90	Robert S. Harris	Stant Inc.	Liquid splash control fuel cap with valve mechanism that closes tank vent when vehicle is overturned, preventing fuel leakage through the cap.
4,919,226	04/24/90	Avtar Singh Rana and Romolo Gandiglio	Fiat Auto S.p.A.	Motor vehicle with a device that releases the fuel tank in the event of a violent rear impact, preventing tank collapse and fuel release.
4,927,045	05/22/90	Helmut J. Lichka	Technolizenz Establishment	Electrostatic or heat-conducting tank fill elements that can be added to a conventional fuel tank, creating an internal grid that prevents local overheating/explosions with only a slight loss of useable tank volume.
4,960,145	10/02/90	Robert A. Schlotzhauer		Fuel line valve that automatically closes if vehicle experiences a sudden impact.
4,964,531	10/23/90	Joseph E. Caniglia and Roberto G. Caniglia		Fuel tank bladder with concentric walled chambers and a combination seal and dike at air vents to prevent fuel release during a tank-rupturing impact.
5,129,544	07/14/92	Wendell L. Jacobson, Thomas R. McCulloch and Dudley L. McCully		Laminated fuel tank with outer layer of impact- and abrasion-resistant plastic, a metallic layer to reflect heat and light away from the tank interior, a vapor barrier layer of Teflon or similar material, and an inner lining of chemically resistant plastic.
5,247,958	09/28/93	Eric Deparis and Serge Pergebois	Solvay & Cie	Safety valve for fuel tank vent pipe that allows normal flow of vapors, but prevents the escape of liquid fuel if vehicle overturns.
5,277,217	01/11/94	Jiro Kobayashi, Harumitsu Sugiyama and Michael J. Feely	Nissan Motor Co., Ltd. and Kato Hatsujo Kaisha Limited	Fuel tank pressure release valve that interrupts fuel flow and prevents leakage if the vehicle experiences excessive tilt or overturns.

5,314,733	05/24/94	Keiichi Saito and Koji Nishida	Mitsubishi Petrochemical Co., Ltd.	Laminated fuel tank constructed of thermoplastic resins treated in such a manner that the finished tank has improved impact resistance, vapor barrier properties, and resistance to hydrocarbon solvents.
Patent No.	Date Issued	Inventors	Assignee	Description
5,325,882	07/5/94	Alan K. Forsythe, Zdenek Gabrlík and John M. Morris	GT Development Corporation	Fuel tank filler cap with a thermally activated pressure relief valve that automatically vents the tank if the temperature becomes excessive.
5,344,038	09/06/94	Richard B. Freeman and Bruce N. Greve	The Budd Company	Composite fuel tank constructed of fiber-reinforced plastic surrounding a flexible inner liner of resin-impregnated fibrous material, which protects against fuel corrosion and serves as a secondary fuel containment means if the shell is ruptured by impact.
5,384,172	01/24/95	Yutaka Takado, Toshikazu Nakasato, Tetsuro Nogata, Eiji Tezuka and Toshio Yokoi	Tonen Chemical Corporation and Toyota Jidosha Kabushiki Kaisha	Plastic fuel tank with at least one high-density polyethylene layer and one polyamide layer bonded strongly together to provide vapor barrier properties and excellent impact resistance.
5,398,839	03/21/95	Hendrik Kleyn	Kleyn Die Engravers, Inc.	Impact-resistant plastic fuel tank with a compartmentalized inner shell and an outer shell sandwiching a fuel absorbent material.
5,402,818	04/04/95	Joji Kasugai, Yoshihiro Nagino and Toshihiko Asaya	Toyoda Gosei Co., Ltd.	Fuel tank vapor pressure regulator incorporating a float-type valve to prevent liquid fuel discharge, and capable of relieving tank fuel vapor buildup even when the float valve is closed.
5,409,030	04/25/95	Younkwan Sung	Hyundai Motor Company	Apparatus for preventing outflow of fuel from fuel tank, with a check valve for discharging accumulated fuel vapors.
5,415,316	05/16/95	Clifford H. Pemberton and Robert M. Farmer	C&V Leasing, Inc.	Plastic fuel tank with recessed fill cap design for better structural integrity and prevention of fuel loss upon sudden impact.
<i>Canada</i> 705,745	03/16/65	Gyula Nemeth		Fire and explosion-preventing container for storage of fuels and gases that contains partitioned cells of nonflammable, non-corrosive, chemically inert material.
<i>U.K.</i>	07/27/66	Gianfranco Santucci		Device that automatically interrupts current from the feed battery to the

1,037,215

electric system in the event of vehicle impact or rollover to prevent short circuit sparks that might ignite fuel.