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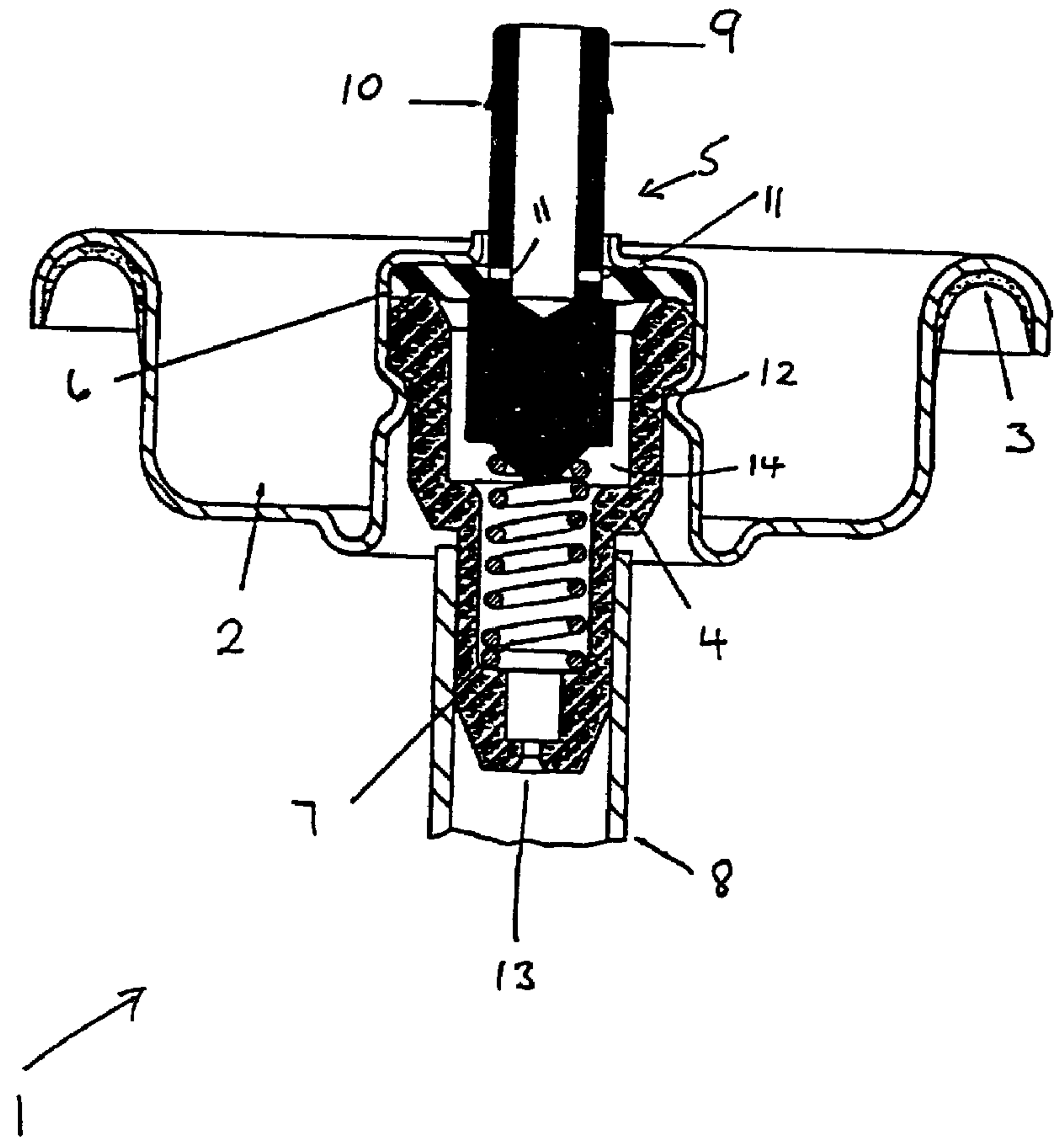
(54) Titre : COMPOSITION DE SCELLANT ANHYDRE ET DE GONFLAGE, POUR PNEU
(54) Title: ANHYDROUS TIRE SEALANT AND INFLATOR COMPOSITION



(57) Abrégé/Abstract:
An anhydrous tire sealant and inflator composition. The composition comprises gaseous hydrofluorocarbon propellant, a sealant composition and an anhydrous solvent blend for the sealant composition. The solvent has a boiling point of 35-320°C and does not

(57) Abrégé(suite)/Abstract(continued):
exhibit a flash point (Seta-flash closed-Cup) below 115°C. The solvent blend liquid chlorinated hydrocarbon and a liquid hydrocarbon, in which the liquid chlorinated hydrocarbon is methylene chloride, trichloroethylene and perchloroethylene, and mixtures thereof. The liquid hydrocarbon has a flash point of at least 35°C and having an evaporation rate greater than 0.03 relative to the evaporation rate of n-butyl acetate. The liquid hydrocarbon is selected from paraffins, isoparaffins and cycloparaffins of 9-16 carbon atoms and is 10-60% by weight of the solvent. Aerosol containers containing the composition are also disclosed.

ABSTRACT OF THE DISCLOSURE

An anhydrous tire sealant and inflator composition. The composition comprises gaseous hydrofluorocarbon propellant, a sealant composition and an anhydrous solvent blend for the sealant composition. The solvent has a boiling point of 35-320°C and does not exhibit a flash point (Seta-flash closed-Cup) below 115°C. The solvent blend liquid chlorinated hydrocarbon and a liquid hydrocarbon, in which the liquid chlorinated hydrocarbon is methylene chloride, trichloroethylene and perchloroethylene, and mixtures thereof. The liquid hydrocarbon has a flash point of at least 35°C and having an evaporation rate greater than 0.03 relative to the evaporation rate of n-butyl acetate. The liquid hydrocarbon is selected from paraffins, isoparaffins and cycloparaffins of 9-16 carbon atoms and is 10-60% by weight of the solvent. Aerosol containers containing the composition are also disclosed.

Title

ANHYDROUS TIRE SEALANT AND INFLATOR COMPOSITION

The present invention relates to an anhydrous, essentially non-flammable sealant and inflator composition, and in particular to a solvent-based tire sealant and inflator composition having a propellant that is a hydrofluorocarbon (HFC) propellant. The composition is intended for use in sealing and inflating pneumatic tires in the event that the tire is punctured.

Portable aerosol containers of tire sealant compositions and propellant are well known for use in an emergency to inflate and temporarily seal a pneumatic tire that has a puncture, when a service station or other repair facility is not immediately available to the motorist. The compositions are particularly intended to be used on automobile tires. The use of the tire sealant composition will often allow the motorist to drive the vehicle to a convenient location, especially a service station, where the punctured tire can be inspected and repaired. The use of the portable aerosol container containing the tire sealant and inflator composition is intended to obviate the need for a motorist to remove the punctured tire from the automobile and replace it with a spare tire in order to reach the service station. It could also eliminate the inconvenience and danger of being stranded on the road with a punctured tire if the motorist either does not have a spare tire or is physically unable to replace the punctured tire with a spare tire.

In typical examples of commercially available tire sealant and inflator compositions, the composition including propellant is in a so-called aerosol container (can) and it is introduced from the container directly into the interior cavity of the pneumatic tire. One method utilizes a length of flexible tubing that is connected from the valve stem of the container to the valve on the tire. The tire sealant and inflator composition is carried into the tire by the propellant on activation (depression) of the valve stem on the container. A second method utilizes a 1.5 inch (3.5 cm) rigid plastic stem adapter instead of a flexible hose assembly. The adapter fits on the valve housing of the aerosol container and is designed to open both the container valve and the tire valve when firmly seated on a tire valve stem. Both the flexible hose assembly system and the rigid adapter are used with so-called male aerosol valves where there is a valve stem protruding from the valve housing. Similar adapters or hose assemblies could be used on so-called female aerosol valves, when made commercially available. Other types of containers are known.

Traditionally, tire sealing and inflator compositions utilized hydrocarbons or chlorofluorocarbons as propellants and inflators. However, most hydrocarbon propellants are flammable, and consequently there are potential risks associated with the use of hydrocarbons as inflators, including fire hazards in a service station when a tire is removed for repair. In contrast, chlorofluorocarbons (CFCs) are non-flammable and have been used widely for refrigerants, in air conditioners, as aerosol propellants and as blowing agents in the manufacture of foam insulation. CFCs are generally viewed as being non-toxic, non-flammable and safe to use in proximity to humans, but are now known to have harmful effects on the ozone layer in the atmosphere. For this reason, efforts have been made internationally, including the Montreal protocol, to protect the ozone layer by limiting the amount of CFCs released into the atmosphere.

Subsequently, hydrochlorofluorocarbons (HCFCs) were developed as propellants for the above uses, including use as the propellant in tire inflator compositions. Chlorodifluoromethane i.e. hydrochlorofluorocarbon 22 (HCFC 22), became a preferred propellant because it does not have a flash point and is non-flammable. HCFCs have substantially less detrimental effect than CFCs on the ozone layers of the atmosphere, but there is a need for further reductions in the effects of propellants on the ozone layer.

Alternatives to HCFCs and CFCs are hydrofluorocarbons and perfluorocarbons. Some examples of these are: 1,1,1,2,3,3,3-heptafluoropropane or HFC 227ea, trifluoromethane or HFC 23, difluoromethane or HFC 32, pentafluoroethane or HFC 125, 1,1,1,2-tetra-fluoroethane or HFC 134a, 1,1-difluoroethane or HFC 152a, perfluoropropane and perfluorobutane. These compounds could be used alone or in blend combinations. Some of these compounds blend to form azeotropic mixtures, where the vapour pressure of the blend is either above or below that of the pure components. As an example, HFC 152a is flammable, but it is known that blends of HFC 152a and HFC 227ea may be prepared that are non-flammable and have vapour pressures that are within regulatory specifications for pressures for aerosol containers at the prescribed temperature limits.

A variety of anhydrous i.e. solvent-based, compositions useful as a tire sealant and inflator composition are known. For instance, U.S. Patent 4,970,242 discloses a tire sealant and inflator composition of a butadiene-styrene rubber copolymer or natural rubber soluble in a solvent, in which the propellant is a hydrochlorofluorocarbon (HCFC) propellant. U.S. Patent 4,426,468 discloses a butyl rubber based sealant composition in a variety of hydrocarbon, chlorinated hydrocarbon and other organic solvents. Canadian Patent 2,129,961 discloses a anhydrous, essentially non-flammable sealant and inflator composition comprising propellant, solvent and thermoplastic acrylic resin, in embodiments of which propane, isobutane, n-butane or dimethylether is added in amounts of 0.5 to 15 weight percent.

U.S. Patent 4,124,395 describes a water-based tire sealant and inflator composition in which the preferred propellant is 1,1,1,2-tetrafluoroethane (hydrofluorocarbon 134a).

An improved tire sealant and inflator composition that utilizes a hydrofluorocarbon propellant has now been found.

Accordingly, one aspect of the present invention provides an anhydrous tire sealant and inflator composition comprising:

a) a propellant comprising gaseous hydrofluorocarbon propellant;

b) a sealant composition; and

c) an anhydrous solvent blend for the sealant composition, said anhydrous solvent blend having a boiling point range of 35-320°C and not exhibiting a flash point below 115°C as measured according to the procedures of Setaflash Closed-Cup Apparatus test method, said anhydrous solvent blend comprising liquid chlorinated hydrocarbon and a liquid hydrocarbon, said liquid chlorinated hydrocarbon being selected from methylene chloride, trichloroethylene and perchloroethylene, and mixtures thereof, said liquid hydrocarbon having a flash point of at least 35°C as measured according to procedures of Tag Closed Tester method and having an evaporation rate greater than 0.03 relative to the evaporation rate of n-butyl acetate, said liquid hydrocarbon being selected from paraffins, isoparaffins and cycloparaffins of 8-20 carbon atoms and mixtures thereof, and being 10-60% by weight of the anhydrous solvent blend.

A further aspect of the present invention provides an aerosol container containing an anhydrous tire sealant and inflator composition comprising:

a) a propellant comprising gaseous hydrofluorocarbon propellant;

b) a sealant composition; and

c) an anhydrous solvent blend for the sealant composition, said anhydrous solvent blend having a boiling point range of 35-320°C and not exhibiting a flash point below 115°C as measured according to the procedures of Setaflash Closed-Cup Apparatus test method, said anhydrous solvent blend comprising liquid chlorinated hydrocarbon and a liquid hydrocarbon, said liquid chlorinated hydrocarbon being selected from methylene chloride, trichloroethylene and perchloroethylene, and mixtures thereof, said liquid hydrocarbon having a flash point of at least 35°C as measured according to procedures of Tag Closed Tester method and having an evaporation rate greater than 0.03 relative to the evaporation rate of n-butyl acetate, said liquid hydrocarbon being selected from paraffins, isoparaffins and cycloparaffins of 8-20 carbon atoms and mixtures thereof, and being 10-60% by weight of the solvent,

said aerosol container having a valve system with at least one gasket, said gasket being formed from buna rubber, low durometer buna rubber or fluoroelastomer.

Yet another aspect of the present invention provides an aerosol container containing an anhydrous tire sealant and inflator composition comprising:

a) a propellant comprising gaseous hydrofluorocarbon propellant;

b) a sealant composition; and

c) an anhydrous solvent blend for the sealant composition, said anhydrous solvent blend having a boiling point range of 35-320°C and not exhibiting a flash point below 115°C as measured according to the procedures of Setaflash Closed-Cup Apparatus test method, said anhydrous solvent blend comprising liquid chlorinated hydrocarbon and a liquid hydrocarbon, said liquid chlorinated hydrocarbon being selected from methylene chloride, trichloroethylene and perchloroethylene, and mixtures thereof, said liquid hydrocarbon having a flash point of at least 35°C as measured according to procedures of Tag Closed Tester method and having an evaporation rate greater than 0.03 relative to the evaporation rate of n-butyl acetate, said liquid hydrocarbon being selected from paraffins, isoparaffins and cycloparaffins of 8-20 carbon atoms and mixtures thereof, and being 10-60% by weight of the anhydrous solvent blend,

said aerosol container having a valve system with at least one gasket, said gasket exhibiting swell of less than 10% when exposed to the tire sealant and inflator composition at 25°C for a period of 30 days and a change in Shore A Durometer hardness of less than 15% when exposed to the tire sealant and inflator composition for 30 days at 25°C.

As referred to and described herein, the gasket may be in the form of an O-ring.

In embodiments of the present invention, the anhydrous solvent blend does not exhibit a flash point. In other embodiments, the anhydrous solvent blend exhibits a flash point of at least 115°C as measured according to the procedures of Setaflash Closed-Cup Apparatus test method.

The Tag Closed Tester method for the measurement of flash point referred to herein is "Standard Test Method for Flash Point by Tag Closed Tester, ASTM D-56", and is used in the measurement of flash point of liquid hydrocarbons.

The Setaflash Closed-Cup Apparatus test method for the measurement of flash point referred to herein is "Standard Test Method for Flash Point of Liquids by Setaflash Closed-Cup Apparatus, ASTM D-3278", and is used in the measurement of flash point of the anhydrous solvent blend.

The present invention will be illustrated with reference to the embodiments shown in the drawings, in which:

Fig. 1 is a schematic representation of a cross-section of a valve system of an aerosol container; and

Fig. 2A and 2B are schematic representations of exploded views of a tilt action valve and a standard valve, respectively.

The tire inflator and sealant composition of the present invention comprises propellant, sealant composition and anhydrous solvent. The propellant is a hydrofluorocarbon (HFC), and does not include gaseous chlorofluorocarbons (CFCs) or hydrochlorofluorocarbons (HCFCs). The latter contain chlorine.

Hydrofluorocarbon compounds and mixtures that are useful for the purposes of this invention are compounds and mixtures that exhibit a vapour pressure at temperatures down to -30°C, or slightly lower, that is capable of expelling the contents of the aerosol container into a tire. Additionally, the vapour pressure in the container should not exceed 1245 kPa (gauge pressure) at 55°C, i.e. 180 psig at 130°F, which is the regulatory limit for commonly available DOT specification 2Q or TC specification 2Q containers; DOT is the Department of Transportation (United States), and TC is Transport Canada.

The 2Q specification is an aerosol container manufacturing specification, as is known, and it describes the metal and seam requirements for three-piece tinplate aerosol containers used with high pressure products. The pressure in an aerosol container increases as the temperature rises, and a 2Q specification container is designed to withstand 1245 kPa (gauge) or 180 PSIG without deforming; this type of container is designed so that it will not bust until the pressure in the container is above 1870 kPA (gauge). Formulations used with this container specification should not exceed 1245 kPa (gauge) pressure at 55°C.

The vapour pressure in the container is not solely a function of the propellant, because certain blends of solvents in combination with a propellant will either reduce or increase the vapour pressure in comparison to liquified propellant gas alone. Chlorinated solvents have the property of depressing the vapour pressure of HFC propellants with the result that the pressure in the container is below the specification limit for an aerosol can at 55°C, even though a propellant such as HFC 134a has a vapour pressure greater than the specification limit of 1245 kPa (gauge) at this temperature. A preferred example of a gaseous hydrofluorocarbon is 1,1,1,2-tetrafluoroethane.

The liquid chlorinated hydrocarbon is selected from methylene chloride, trichloroethyelene and perchloroethylene, and mixtures thereof. Other chlorinated solvents are not included in the definition of liquid chlorinated hydrocarbon. For instance, chloroform, carbon tetrachloride, 1,1,1-tri-chloroethane, ethylene dichloride, propylene dichloride, monochlorobenzene and orthodichlorobenzene are not included. Chloroform and carbon tetrachloride are regarded as being potential health hazards. Carbon tetrachloride is also unacceptable for ozone depletion properties. 1,1,1-trichloroethane has been removed from commercial use because of ozone depletion properties. 1,1-dichloro 1-fluoroethane is classed as an ozone depleter and is not permitted in consumer applications such as tire inflators.

The solvent of the tire sealant and inflator composition is an anhydrous solvent i.e. the solvent used in the compositions of the invention does not contain water. The solvent is a two-part solvent. The first part of the solvent is a chlorinated hydrocarbon having 1-2 carbons atoms, specifically perchloroethylene, methylene chloride, and trichloroethylene, and mixtures thereof. These chlorinated hydrocarbons do not have a flash point, have acceptable ozone depleting properties and have an acceptable health hazard rating.

The second part of the solvent is a liquid hydrocarbon. The liquid hydrocarbon is characterized by having a flash point (Tag Closed Tester) of at least 35°C and an evaporation rate greater than 0.03 relative to n-butyl acetate evaporation rate being defined as 1.0. The hydrocarbon solvent can be selected from the paraffins, isoparaffins, or cycloparaffins (naphthenic hydrocarbons), and mixtures thereof, with 8-20 carbon atoms in the molecular structure.

Liquid hydrocarbons can be defined by their Chemical Abstract Service (CAS) Registry Numbers. Hydrocarbons obtained from commercial petrochemical refineries are typically defined using CAS Registry numbers. CAS Registry numbers for examples of hydrocarbon solvents useful for this invention include:

8052-41-3	Stoddard Solvent,
64741-65-7	Naphtha (petroleum), heavy alkylate,
64741-73-7	Distillates (petroleum), alkylate,
64741-77-1	Distillates (petroleum), light hydrocracked,
64741-86-2	Distillates (petroleum), sweet middle,
64741-91-9	Distillates (petroleum), solvent-refined middle,
64742-06-9	Extracts (petroleum), middle distillate solvent,
64742-13-8	Distillates (petroleum), acid-treated middle,
64742-14-9	Distillates (petroleum), acid-treated light,
64742-30-9	Distillates (petroleum), chemically neutralized middle,

64742-31-0	Distillates (petroleum), chemically neutralized light,
64742-38-7	Distillates (petroleum), clay-treated middle,
64742-47-8	Distillates (petroleum), hydrotreated light,
64742-72-9	Distillates (petroleum), catalytic dewaxed middle,
64742-77-4	Distillates (petroleum), complex dewaxed middle,
64742-88-7	Solvent naphtha (petroleum), middle aliphatic,
64742-94-5	Solvent naphtha (petroleum), heavy aromatic,
64742-96-7	Solvent naphtha (petroleum), heavy aliphatic

The chlorinated hydrocarbon and liquid hydrocarbon may be blended in a variety of ratios. In particular, the liquid hydrocarbon is 10-60% by weight of the anhydrous solvent blend, preferably 20-50% by weight of the anhydrous solvent blend. The liquid hydrocarbon has a boiling point in the range of 120-320°C and is preferably a distillate blend with a boiling point in the range of 120-320°C e.g. one or more of the hydrocarbons for which CAS numbers are listed above. The anhydrous solvent blend has a boiling point of 35-320°C. In embodiments, especially in the absence of methylene chloride, the boiling point of the anhydrous solvent blend is 120-320°C.

The liquid hydrocarbon flash point can be inerted by blending it with a sufficiently high proportion of the chlorinated solvent. Thus, anhydrous solvent blends can be produced that have no flash point (Setaflash Closed-Cup) below 115°C even though the liquid hydrocarbon has a flash point (Tag Closed Tester) of about 50°C.

The evaporation rate test is a standard test viz. ASTM D-3539; Standard Test Method for Evaporation Rates of Volatile Liquids by Shell Thin-Film Evaporometer. This method involves spreading a known volume of liquid on a known area of filter paper that is suspended from a sensitive balance in a cabinet. Dried air or nitrogen at 25°C is passed through the cabinet at a known rate. The loss of weight of the filter paper/liquid is determined and plotted against time. This is compared to the weight loss of a standard test solvent under the same conditions.

As exemplified in the examples, it is necessary to have liquid hydrocarbon present in the solvent in order to prevent unacceptable deterioration of O-rings and gaskets in the aerosol container used to dispense the tire sealant and inflator composition.

Aerosol valve manufacturers commonly manufacture aerosol valves using one of five types of rubber for the sealing O-rings in the valves. These five rubber compounds are generally referred to by the names of the major rubber proportion in the rubber compounds viz. buna, low durometer buna, butyl, neoprene and Viton™ rubber, also known as a fluoroelastomer, especially Viton A fluoroelastomer.

Examples of the compositions of the rubbers are as follows. Buna rubber is a copolymer of butadiene and styrene monomers. Butyl rubber is typically about 97% isobutylene and 3% isoprene blend. Neoprene is a copolymer where one of the major monomers is chloroprene. Viton™ rubber is a fluoroelastomer and is a copolymer where one of the main monomers has a fluorine atom. Butadiene, chloroprene and the fluoroprene monomers are molecules with four carbon atoms in a linear chain with two double bonds. Long chain polymerization can result in cross links or cross link sites for rubber hardening or vulcanization, to produce high Durometer rubbers. Low Durometer buna rubber is made using less severe cross linking conditions.

The specific blends of monomers of the rubbers for gaskets are proprietary to the valve gasket manufacturers. However, it is believed that the changes in chemical side groups affects the rubber compound's ability to withstand solvent attack from various solvents or solvent families.

The sealant composition of the invention also contains a sealant. A variety of sealants may be used, including rubber materials, polybutenes and acrylic polymers. The sealant is intended to form a continuous coating on the interior of the tire, especially in and near the puncture in the tire.

Examples of rubber material of the sealant include styrene/butadiene copolymers, especially such polymers cross-linked with divinyl benzene. Such materials are available, for instance, under the trade designations SBR-1009, SBR-8107 and SBR-1013 from American Synpol Corporation.

The polybutenes are long chain polymers of 1-butene, (*cis*) 2-butene and/or (*trans*) 2-butene. Polybutenes tend to form lower viscosity solutions than some styrene-butadiene resin solutions. Examples of polybutenes include Parapol™ 950 from Exxon Chemical Company, Polybut™ 10, Polybut 30, Polybut 128, Polybut 150 and Polybut 200 from Polibutenos Argentinos S.A.

The acrylic resin may be an acrylic acid polymer, an acrylic acid copolymer, a methacrylic acid polymer or a methacrylic acid copolymer, or a polymer or copolymer of ester derivatives thereof. Examples of acrylic resins include butyl methacrylate acrylic resin e.g. Elvacite™ 2044 and 2046 which are available from ICI Acrylics.

The rubber, polybutene or acrylic resin of the sealant must dissolve in the solvent system. Some rubber or resin materials such as nitrile rubbers do not dissolve in the solvent blend in this invention and are not covered by this patent.

It is to be understood that in addition to rubber materials and acrylic resins, the sealant may contain tackifying resins, rheological agents, surfactants or other materials that assist in forming a sealant coating on the interior of the tire.

Examples of tackifier resins include coumarone-indene resins e.g. coal tar resins, indene resins, polycoumarone resins, polyindene resins, and rosins, which are natural resins obtained from pine oleoresin after removal of volatile fractions. An example of a rosin is Poly-Pale™ resin, which is described as a high softening-point, non-crystallizing acidic resin, and is available from Hercules Inc. A dimeric acid derived from rosin type resin with other rosin resin fractions is Dymerex™ resin from Hercules Inc. Neville Chemical Company supplies coumarone-indene resins including Cumar™ R-12 and Paradene™ #2, alkylated hydrocarbon resins including Nevchem™ 140, modified hydrocarbon resins including Nevex™ 100 LC and synthetic polyterpene tackifying resins including Super Nevtac™ 99. All of these resins are believed to be suitable as tackifiers.

The composition may also contain rheological control agents, including clays or derivatives of clays. An example is Bentone™, an organic derivative of a montmorillonite clay.

Referring to the drawings, Fig. 1 shows a cross-section of a valve system used on an aerosol container. Valve system 1 has a valve mounting cup 2, which is adapted to fit onto and be sealed onto an aerosol container at container gasket 3. Valve system 1 has valve body 4 with interior hollow core 14, into which fit valve stem 5, valve gasket 6 and valve spring 7. Valve body 4 fits into dip tube 8, which extends essentially to the bottom of the container, with fluid inlet 13 in the base of valve body 4. The tire sealant composition, and propellant, would enter fluid inlet 13 during use.

Valve stem 5 has stem top 9 which extends downward through valve mounting cup 2. Stem locking ring 10 located on stem top 9 is intended to restrict the travel of stem top 9 into valve body 4 during use. Valve stem 5 further has stem holes 11 and stem base 12. Stem base 12 fits into valve spring 7. Stem holes 11 are located so that when the aerosol container is in a non-use situation, stem holes 11 are located at valve gasket 6, which seals stem holes 11 and prevents the discharge or leakage of the tire sealant composition when it is not required. It is understood that typical valve systems may have one or more stem holes 11 in the valve stem 5.

Fig. 2A and 2B show exploded views of a tilt action valve and a standard valve, respectively, of the type manufactured by Precision Valve Corporation. Although the two valves are different, and have some features which differ in shape, the valves are of substantially the same construction. Each valve has a valve cap 20 with valve orifice 21. Valve cap 20 fits on mounting cup 22. The valve has valve stem 23, valve gasket 24, valve spring 25 and valve base 26, all of which fit together in the manner described in Fig. 1. Dip tube 27 is shown to the side of the exploded view of the valve, but it is intended to fit on the lower part of valve base 26, as described previously.

In use, valve stem 5 is depressed by the user until such time that stem holes 11 are in fluid flow communication with valve core 14. At that time, the tire and sealant composition can flow from the interior of the aerosol container through fluid inlet 13 into valve body 4, pass through valve core 14, through stem holes 11 and exit from the aerosol container through an orifice suitably located in stem top 9. Release of pressure on stem top 9 causes valve body 4 to be urged upward by valve spring 7 at which time the fluid flow communication from valve core 14 through stem holes 11 is disrupted, and stem holes 11 are sealed by valve gasket 6.

It will be appreciated that in order for the valve system to operate effectively, valve gasket 4 must be capable of sealing stem holes 11 when the aerosol container is not in use. However, when the container is used, and stem top 9 is depressed so that stem holes 11 become in fluid flow communication with valve core 14 to permit tire sealant composition to pass from the aerosol container through stem holes 11, it is essential that stem holes 11 remain in an open condition so that the composition can pass through the holes. Thus, the material from which valve gasket 6 is fabricated cannot become brittle in the presence of the tire sealant composition, as this would result in leakage of the contents of the container through stem holes 11. Furthermore, valve gasket 6 cannot unduly swell or become soft, as this causes plugging of valve holes 11 and thereby prevent the discharge of tire sealant composition from the aerosol container.

The present invention provides an anhydrous tire sealant and inflator composition that uses an environmentally acceptable propellant. The composition may be used in aerosol containers, depending on the material used to form gaskets and the intended life of the composition in the container.

The present invention is illustrated by the following examples.

EXAMPLE I

A series of gaskets of a type used in aerosol containers were subjected to various compositions of tire sealant compositions in which the propellant was HFC 134a. The solvent used in the compositions was perchloroethylene admixed with 0-37% by weight of mineral spirits viz. a petroleum fraction (naphtha) consisting of hydrocarbons having chain lengths predominantly in the range of C_8 to C_{20} and boiling in the range of approximately 135-345°C (275-655°F), with a Tag Closed Cup flash point higher than 35°C (95°F) and an evaporation rate greater than 0.03 relative to n-butyl acetate. Commercially available examples include: Clean Sol™ 34, Shell Sol™, Shell Sol 715, TS-28 solvent , TS-34 solvent, Cyclosol™ 53 and Cyclosol 63 all from Shell Oil, and Varsol™ 3135, Varsol 3139, Varsol DX 3139, Exxsol™ D3135, Isopar G, Isopar K, Solvesso™ 100, Varsol 140, and Exxsol D40 all from Imperial Oil. Further details of the compositions are given in Table I.

The gaskets to be tested were measured for size (thickness) and for Shore A Durometer hardness; Durometer hardness may be obtained using the procedure of ASTM D2240. The gaskets were then immersed in the composition for two months in aerosol containers pressurized with the appropriate ratio of propellant and stored at room temperature, which was a temperature of about 25°C. The size and Durometer hardness of the gaskets were then re-measured.

The percentage swelling of the gaskets and the change in hardness were determined. The results obtained are given in Table I.

TABLE I

Compositions*

Formula	A	B	C	D	E
Perchloroethylene	88.31	73.86	68.54	63.20	53.10
Mineral Spirits	0.00	16.00	21.32	26.66	36.76
Elvacite™ 2044	1.05	0.91	0.91	0.91	0.91
Elvacite™ 2046	9.40	8.16	8.16	8.16	8.16
Santicizer™ 160	1.24	1.07	1.07	1.07	1.07
HFC 134a ratio					
Concentrate	60	75	75	75	73
Propellant	40	25	25	25	27

Results
Gasket Swell (Percent)

	A	B	C	D	E
Buna rubber	21	8	7	10	6
Neoprene	Destroyed	Destroyed	Destroyed	Destroyed	Destroyed
Butyl rubber	30	35	39	36	41
Fluoroelastomer	Not Tested	10	9	12	6

Durometer Change

	A	B	C	D	E
Buna	-33	-5	4	3	6
Neoprene	Destroyed	Destroyed	Destroyed	Destroyed	Destroyed
Butyl	-54	-35	-44	-43	-69
Fluoroelastomer	Not Tested	-16	-15	-16	-9

* Mineral spirits - Varsol™ 3139 (Imperial Oil) or Shell Sol 16™ Shell Oil)
Elvacite™ 2044 and 2046 butyl methacrylate acrylic resins (ICI Acrylics)
Santicizer™ (butyl benzyl phthalate) plasticizer (Monsanto)
Fluoroelastomer - Viton™ (Du Pont)

The results show that neoprene and butyl rubber was not an acceptable material for use as gaskets, or O-rings, with compositions of the invention. For buna rubber, the presence of mineral spirits was required to reduce the swell below 10%. For the fluoroelastomer, swell was marginally acceptable.

Similar results were obtained in the hardness tests.

EXAMPLE II

The procedure of Example I was repeated using a different resin composition.

The results are given in Table II.

TABLE II

Compositions*

Formula	**A**	**B**	**C**	**D**	**E**	**F**
Perchloroethylene	81.58	73.16	64.44	56.22	47.95	40.00
Mineral Spirits	0.00	8.13	16.11	24.10	31.97	40.00
SBR 1009	2.85	2.85	2.82	2.81	2.80	2.80
Polypale	7.85	7.82	7.75	7.73	7.69	7.70
Beaverwhite	5.35	5.33	5.29	5.27	5.24	5.25
Z-Light Spheres	1.78	1.78	1.76	1.76	1.75	1.75
Bentone SD-1	0.59	0.93	1.83	2.11	2.60	2.50
Perchloroethylene as a % of solvents	100	90	80	70	60	50
HFC 134a ratio						
Concentrate	73	73	73	73	73	73
Propellant	27	27	27	27	27	27
Results						
Gasket Swell (Percent)						
Buna	15.37	19.70	16.55	11.71	10.43	9.78
Low Durometer	11.50	13.71	9.61	5.33	5.01	4.92
Neoprene	25.53	26.58	21.00	19.02	17.09	13.23
Butyl	27.78	31.21	31.21	28.43	27.22	30.26
Fluoroelastomer	28.38	20.96	14.80	13.53	11.80	28.61
Durometer Change						
Buna	-18	-13	-14	-12	-17	-13
Low Durometer	-9	-15	-9	-10	-7	-8
Neoprene	-20	-21	-18	-20	-20	-21
Butyl	-17	-21	-22	-20	-20	-21
Fluoroelastomer	-36	-28	-27	-23	-21	-31

* Mineral spirits - Varsol™ 3139 (Imperial Oil) or Shell Sol 16™ Shell Oil)
SBR 1009 butyl rubber from American Synpol
Polypale from Hercules

Beaverwhite from Luzenac America Inc.
Z-light spheres Type G-3400 from 3M
Bentone SD-1 from Rheox Inc.

Butyl rubber was not acceptable for gasket swell, for use with the compositions of Table II. Some other compositions were acceptable, or marginally so. Low durometer rubber and buna rubber were generally acceptable for hardness for use as the gasket, with a change of less than 15%.

CLAIMS:

1. An anhydrous tire sealant and inflator composition comprising:

a) a propellant comprising gaseous hydrofluorocarbon propellant;

b) a sealant composition; and

c) an anhydrous solvent blend for the sealant composition, said anhydrous solvent blend having a boiling point range of 35-320°C and not exhibiting a flash point below 115°C as measured according to the procedures of Setaflash Closed-Cup Apparatus test method, said anhydrous solvent blend comprising liquid chlorinated hydrocarbon and a liquid hydrocarbon, said liquid chlorinated hydrocarbon being selected from methylene chloride, trichloroethylene and perchloroethylene, and mixtures thereof, said liquid hydrocarbon having a flash point of at least 35°C as measured according to procedures of Tag Closed Tester method and having an evaporation rate greater than 0.03 relative to the evaporation rate of n-butyl acetate, said liquid hydrocarbon being selected from paraffins, isoparaffins and cycloparaffins of 8-20 carbon atoms and mixtures thereof, and being 10-60% by weight of the anhydrous solvent blend.

2. The composition of Claim 1 in which the liquid chlorinated hydrocarbon is one of methylene chloride, trichlorethylene and perchloroethylene.

3. The composition of Claim 1 in which the liquid chlorinated hydrocarbon is perchloroethylene.

4. The composition of Claim 1 in which the anhydrous solvent blend has a boiling point of 120-320°C.

5. The composition of any one of Claims 1-4 in which the liquid hydrocarbon is a mixture of one or more of paraffins, isoparaffins and cycloparaffins.

6. The composition of any one of Claims 1-5 in which the propellant is 1,1,1,2-tetrafluoroethane.

7. The composition of any one of Claims 1-6 in which the sealant is a rubber material.

8. The composition of any one of Claims 1-6 in which the sealant is a polybutene.

9. The composition of any one of Claims 1-6 in which the sealant is an acrylic resin.

10. The composition of any one of Claims 1-9 in which the composition contains at least one of tackifying resins, rheological agents and surfactants.

11. The composition of any one of Claims 1-10 in which the anhydrous solvent blend does not exhibit a flash point as measured according to the procedures of Setaflash Closed Cup Apparatus test method.

12. The composition of any one of Claims 1-10 in which the anhydrous solvent blend exhibits a flash point of at least 115°C as measured according to the procedures of Setaflash Closed Cup Apparatus test method.

13. The composition of any one of Claims 1-12 in which the liquid hydrocarbon is 20-50% by weight of the anhydrous solvent blend.

14. An aerosol container containing an anhydrous tire sealant and inflator composition comprising:

a) a propellant comprising gaseous hydrofluorocarbon propellant;

b) a sealant composition; and

c) an anhydrous solvent blend for the sealant composition, said anhydrous solvent blend having a boiling point range of 35-320°C and not exhibiting a flash point below 115°C as measured according to the procedures of Setaflash Closed-Cup Apparatus test method, said anhydrous solvent blend comprising liquid chlorinated hydrocarbon and a liquid hydrocarbon, said liquid chlorinated hydrocarbon being selected from methylene chloride, trichloroethylene and perchloroethylene, and mixtures thereof, said liquid hydrocarbon having a flash point of at least 35°C as measured according to procedures of Tag Closed Tester method and having an evaporation rate greater than 0.03 relative to the evaporation rate of n-butyl acetate, said liquid hydrocarbon being selected from paraffins, isoparaffins and cycloparaffins of 8-20 carbon atoms and mixtures thereof, and being 10-60% by weight of the solvent, said aerosol container having a valve system with at least one gasket, said gasket being formed from buna rubber, low durometer buna rubber or fluoroelastomer.

15. An aerosol container containing an anhydrous tire sealant and inflator composition comprising:

a) a propellant comprising gaseous hydrofluorocarbon propellant;

b) a sealant composition; and

c) an anhydrous solvent blend for the sealant composition, said anhydrous solvent blend having a boiling point range of 35-320°C and not exhibiting a flash point below 115°C as measured according to the procedures of Setaflash Closed-Cup Apparatus test method, said anhydrous solvent blend comprising liquid chlorinated hydrocarbon and a liquid hydrocarbon, said liquid chlorinated hydrocarbon being selected from methylene chloride, trichloroethylene and perchloroethylene, and mixtures thereof, said liquid hydrocarbon having a flash point of at least 35°C as measured according to procedures of Tag Closed Tester method and having an evaporation rate greater than 0.03 relative to the evaporation rate of n-butyl acetate, said liquid hydrocarbon being selected from paraffins, isoparaffins and cycloparaffins of 8-20 carbon atoms and mixtures thereof, and being 10-60% by weight of the anhydrous solvent blend, said aerosol container having a valve system with at least one gasket, said gasket exhibiting swell of less than 10% when exposed to the tire sealant and inflator composition at 25°C for a period of 30 days and a change in Shore A Durometer hardness of less than 15% when exposed to the tire sealant and inflator composition for 30 days at 25°C.

16. The aerosol container of Claim 14 or Claim 15 in which the gasket is in the form of an O-ring.

17. The aerosol container of any one of Claims 14-16 in which the liquid chlorinated hydrocarbon is one of methylene chloride, trichlorethylene and perchloroethylene.

18. The aerosol container of any one of Claims 14-16 in which the liquid chlorinated hydrocarbon is perchloroethylene.

19. The aerosol container of any one on Claims 14-16 in which the anhydrous solvent blend has a boiling point of 120-320°C.

20. The aerosol container of any one of Claims 14-19 in which the liquid hydrocarbon is a mixture of one or more of paraffins, isoparaffins and cycloparaffins.

21. The aerosol container of any one of Claims 14-20 in which the propellant is 1,1,1,2-tetrafluoroethane.

22. The aerosol container of any one of Claims 14-21 in which the sealant is a rubber material.

23. The aerosol container of any one of Claims 14-21 in which the sealant is a polybutene

24. The aerosol container of any one of Claims 14-21 in which the sealant is an acrylic resin.

25. The aerosol container of any one of Claims 14-24 in which the composition contains at least one of tackifying resins, rheological agents and surfactants.

26. The aerosol container of any one of Claims 14-25 in which the anhydrous solvent blend does not exhibit a flash point as measured according to the procedures of Setaflash Closed Cup Apparatus test method.

27. The aerosol container of any one of Claims 14-25 in which the anhydrous solvent blend exhibits a flash point of at least

115°C as measured according to the procedures of Setaflash Closed Cup Apparatus test method.

28. The aerosol container of any one of Claims 14-27 in which the liquid hydrocarbon is 20-50% by weight of the anhydrous solvent blend.

29. The aerosol container of any one of Claims 14-28 in which the gasket is buna rubber.

30. The aerosol container of any one of Claims 14-28 in which the gasket is low durometer buna rubber.

31. The aerosol container of any one of Claims 14-28 in which the gasket is fluoroelastomer.

32. The aerosol container of any one of Claims 14-28 in which the gasket is a dipolymer of hexafluoropropylene and vinylidene fluoride.

33. The aerosol container of any one of Claims 14-32 in which the container conforms to 2Q specifications.

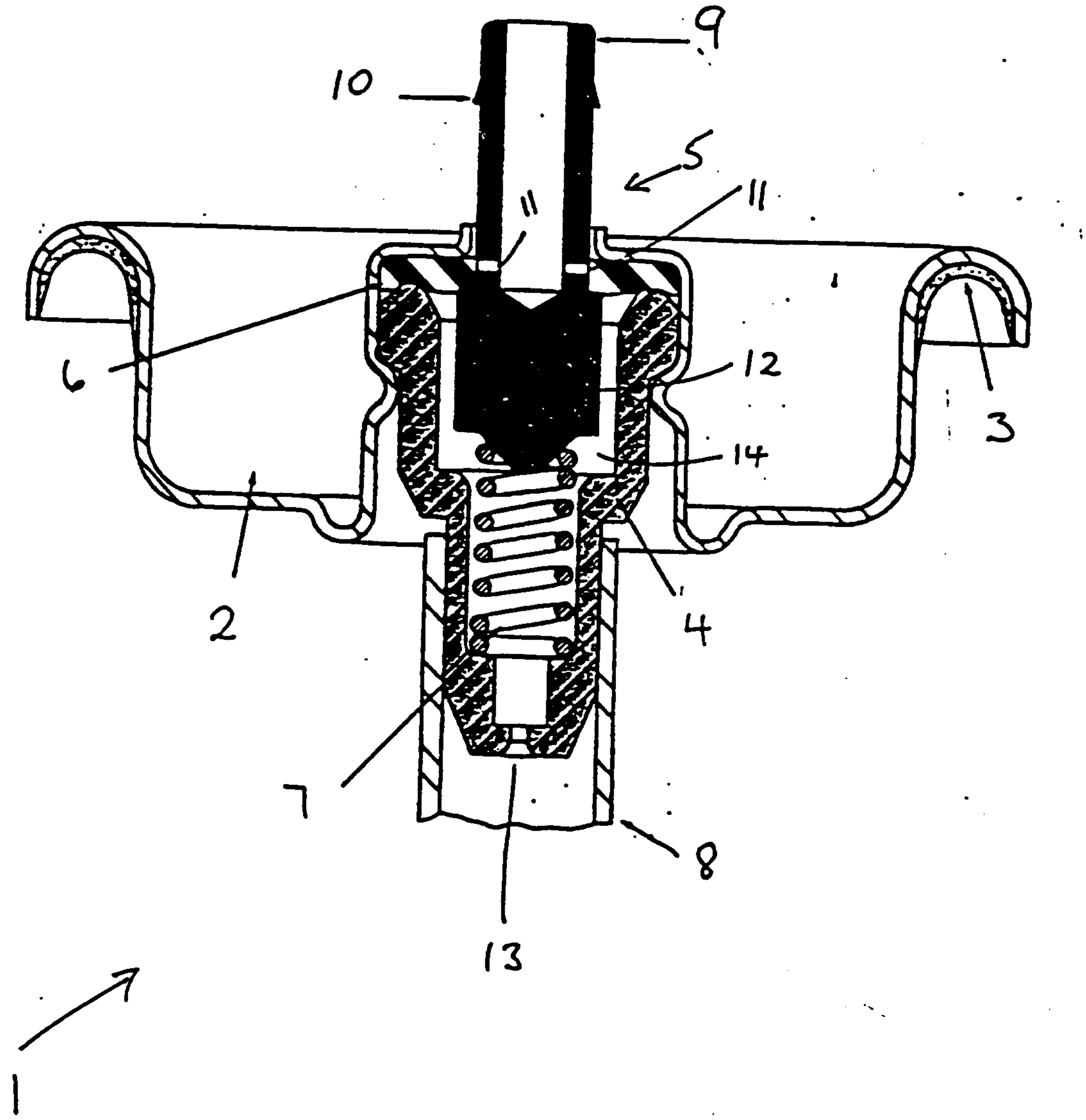


Fig. 1

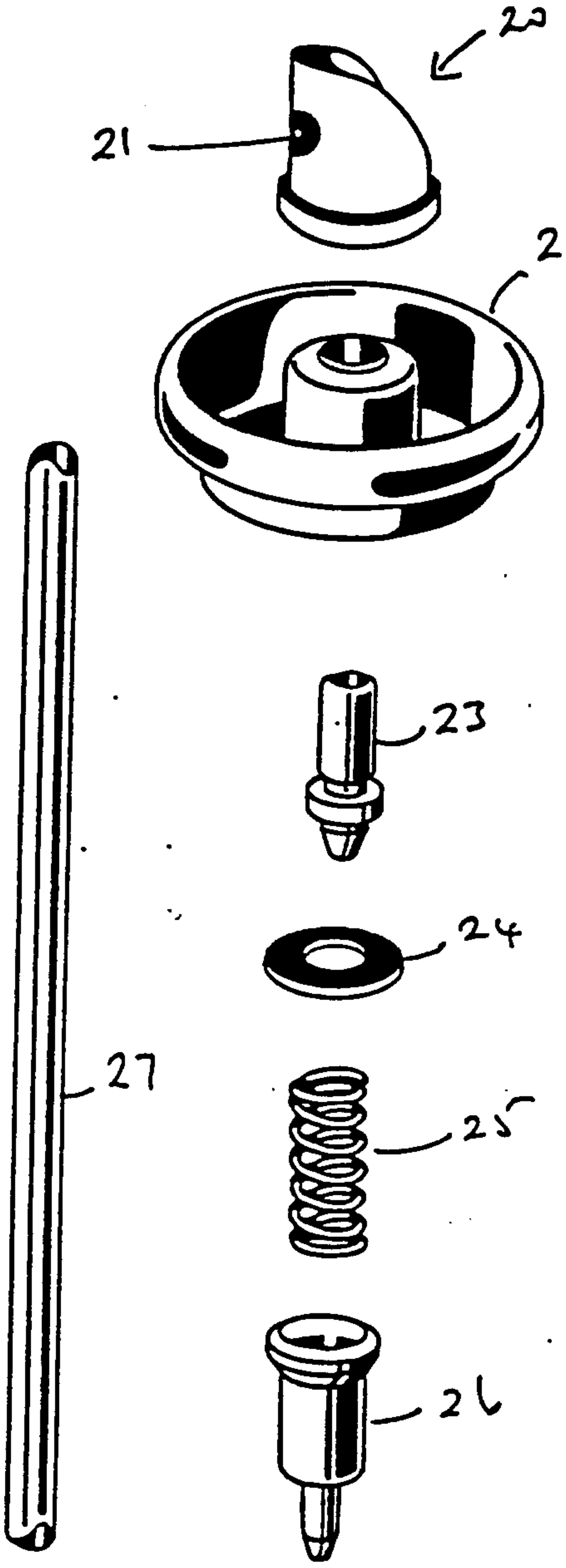


Fig. 2A

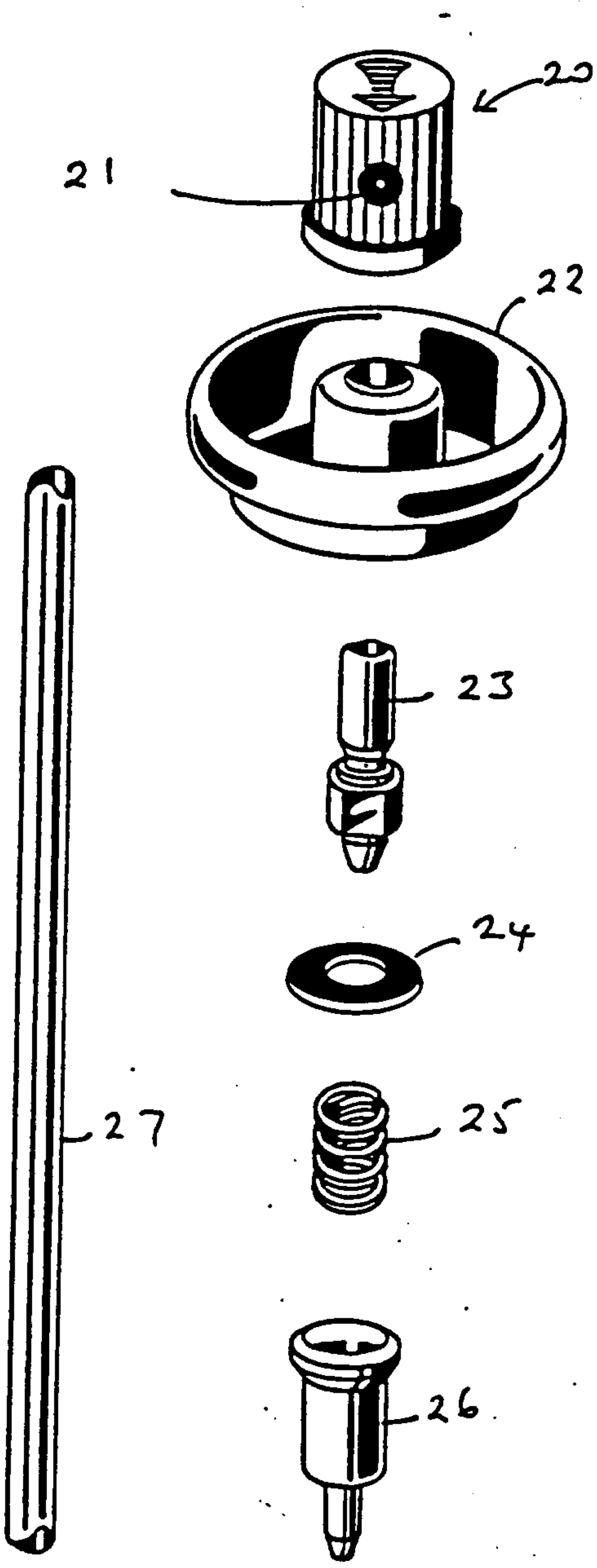
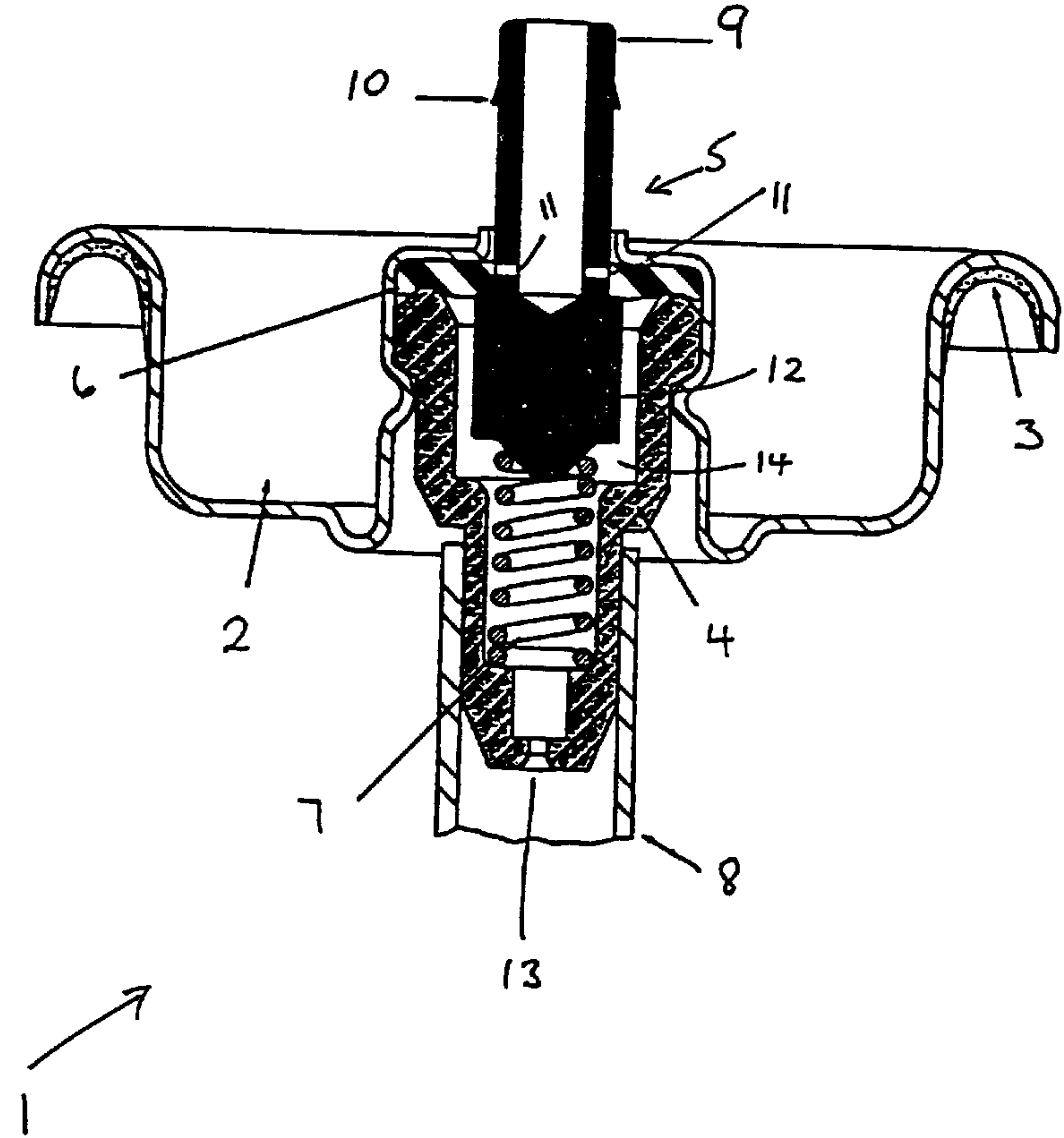


Fig. 2B



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