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Marini

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(54) **KIT FOR INFLATING AND REPAIRING INFLATABLE ARTICLES, IN PARTICULAR TYRES**

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(58) **Field of Classification Search** 141/38, 141/41, 98; 152/415
See application file for complete search history.

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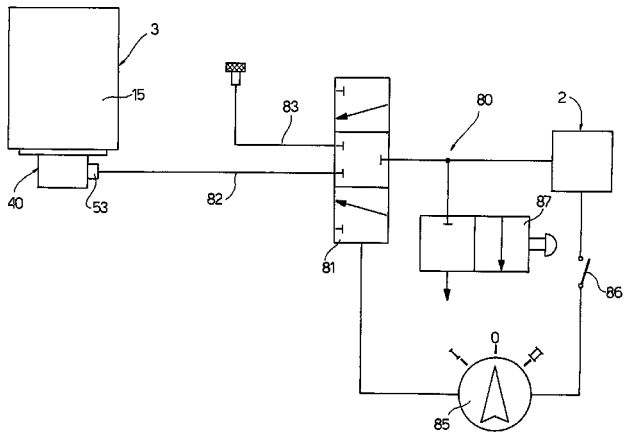
(57) **ABSTRACT**

A kit for inflating and repairing inflatable articles, in particular tires, the kit having a compressor assembly, a container of sealing liquid and connectors for connecting the container to the compressor assembly and to an inflatable article for repair or inflation; the compressor assembly being housed in an outer casing defining a seat for the container of sealing liquid. The container is housed removably in the seat and functionally connected to the compressor assembly so as to form a compact unit ready for use.

31 Claims, 4 Drawing Sheets



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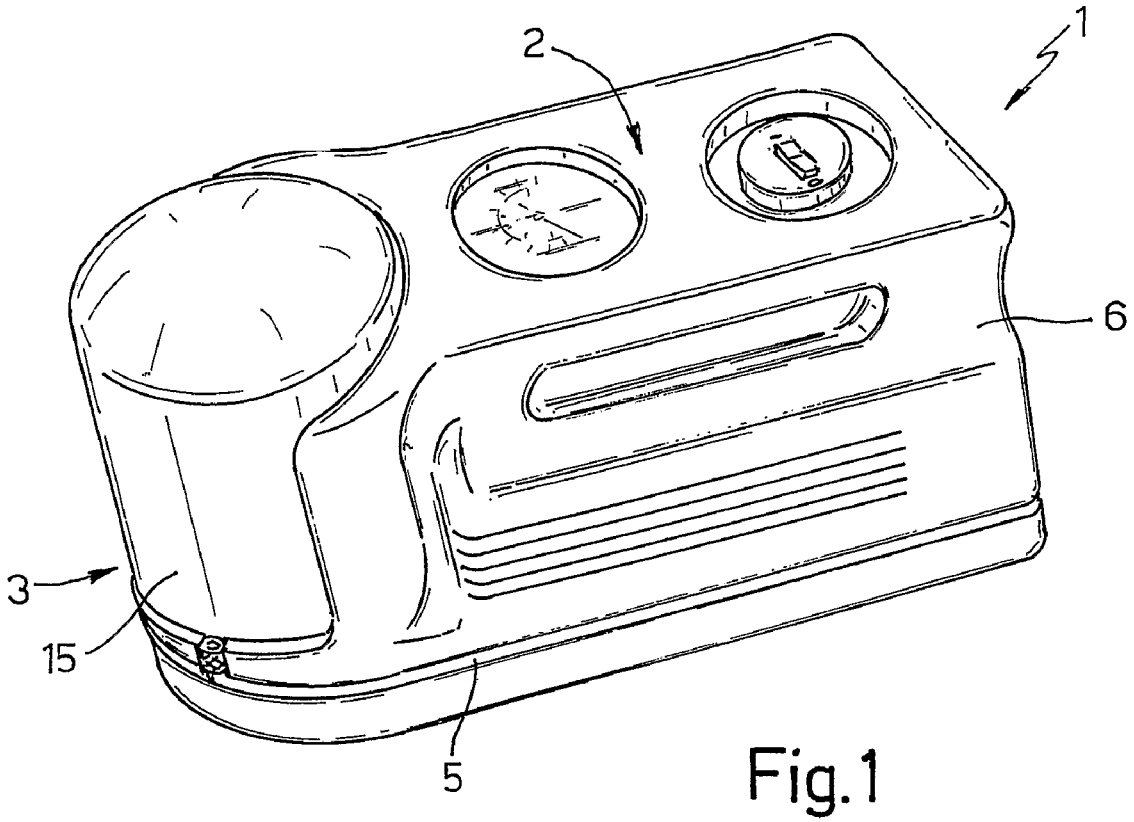

Fig.1

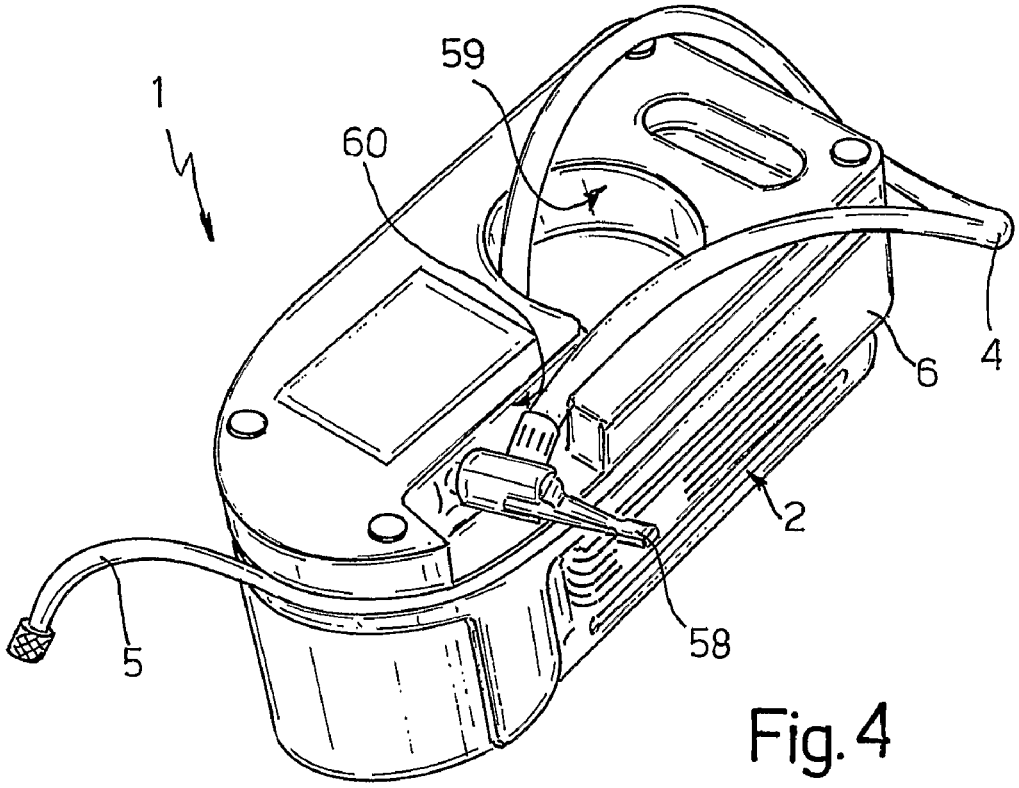

Fig.4

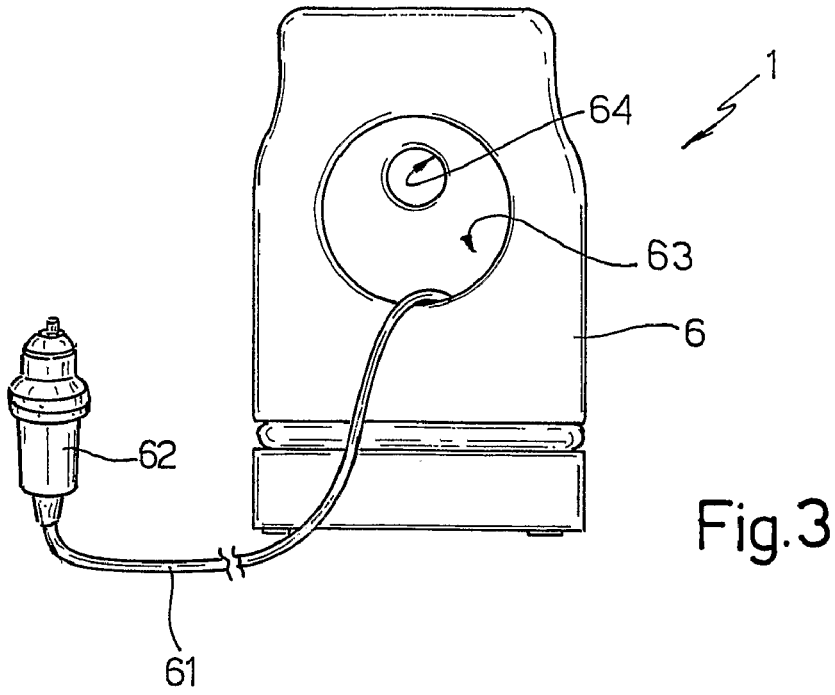

Fig.3

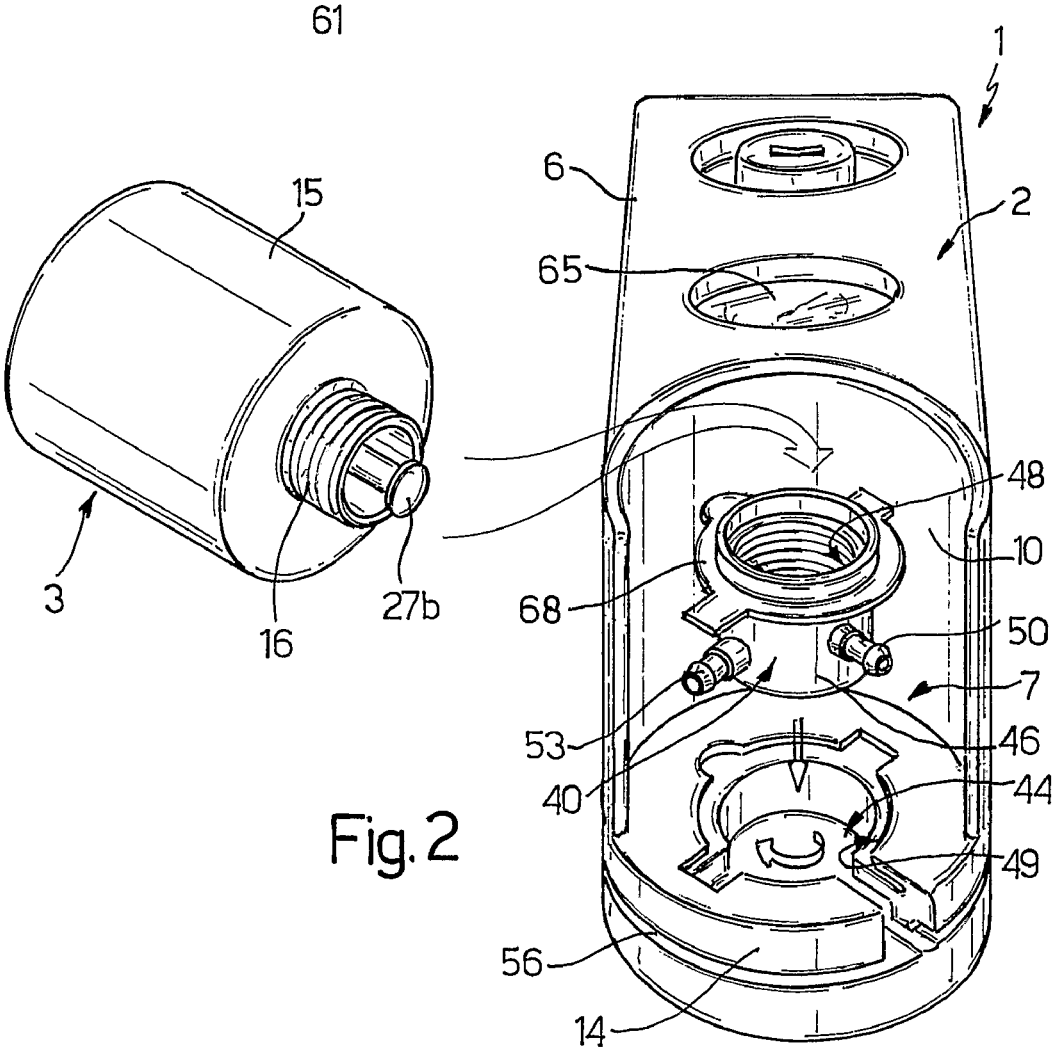

Fig.2

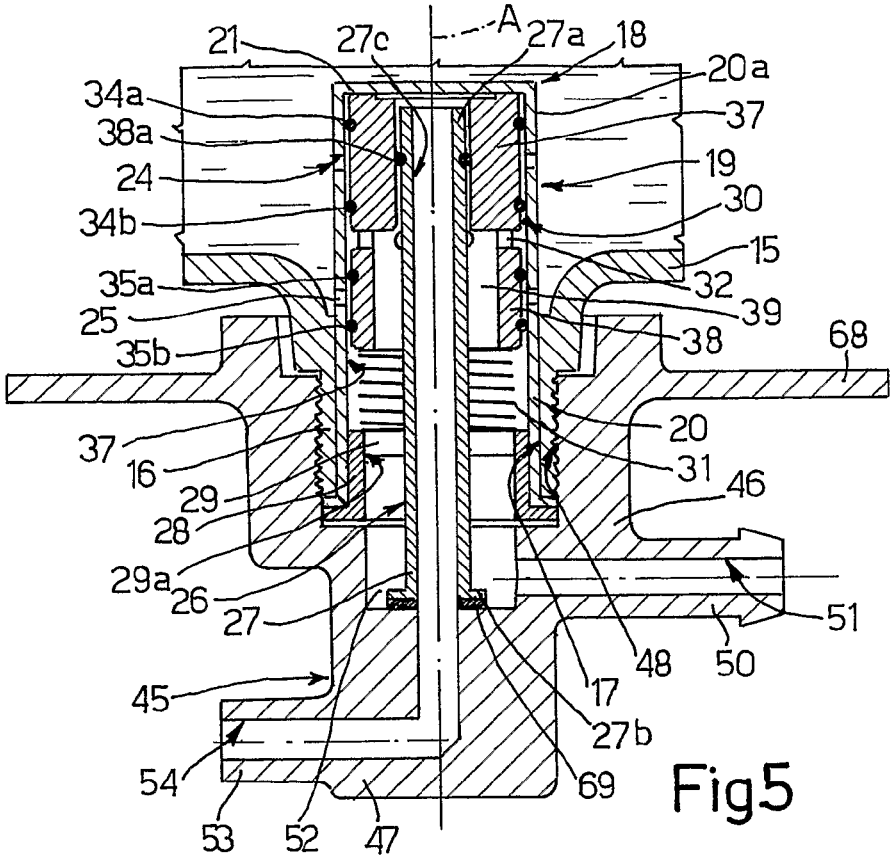
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Fig5

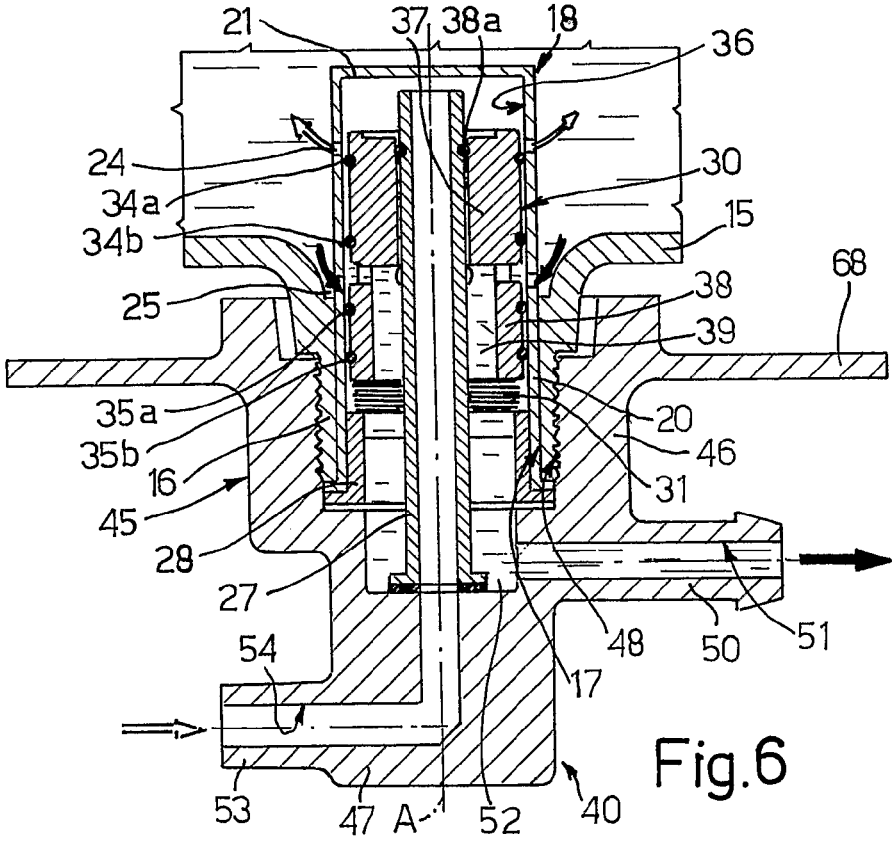
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Fig.6

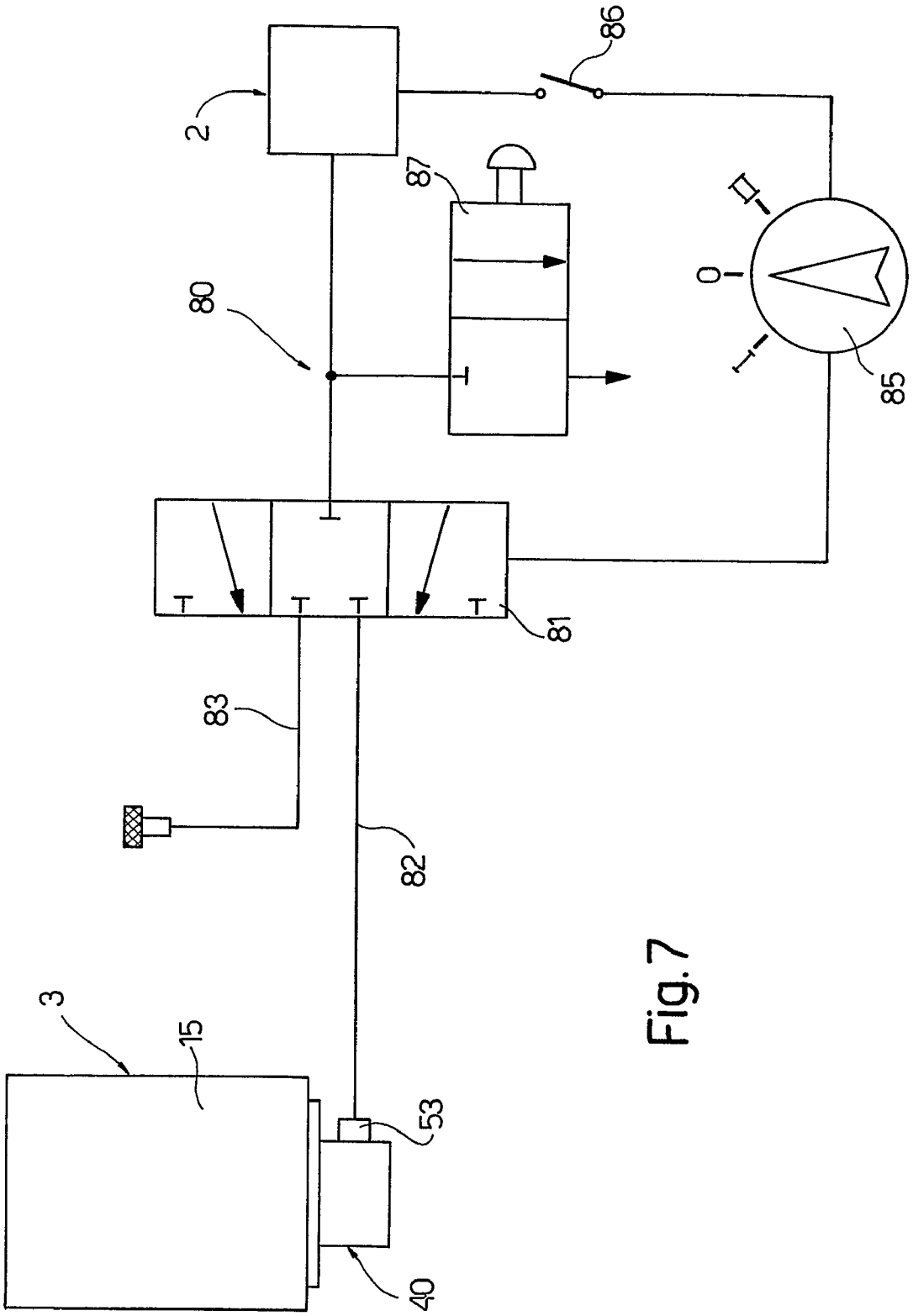

Fig.7

KIT FOR INFLATING AND REPAIRING INFLATABLE ARTICLES, IN PARTICULAR TYRES

TECHNICAL FIELD

The present invention relates to a kit for inflating and repairing inflatable articles, in particular, tyres.

BACKGROUND ART

Sealing liquids for fast repair of inflatable articles are known. The liquid is fed into the article for repair by means of compressed air, e.g. by means of a compressor, penetrates any holes or slits in the article, and sets on contact with air, thus rapidly sealing the article.

Such liquids are widely used for fast tyre repair, to which the following description refers for the sake of clarity and purely by way of example.

Vehicle spare wheels pose a number of well-known problems, not least of which are their considerable size and weight.

More specifically, if the wheel is housed inside the vehicle, normally in a compartment to the side of or beneath the boot, the capacity of the boot is greatly reduced, and the tyre is difficult to remove, especially when the boot is full.

Conversely, if stowed outside the vehicle, normally in a compartment beneath the floor, or attached to the rear door, the wheel can easily be stolen and is still not easy to remove.

Given the good road conditions in most countries, punctures are now rare, so that changing a wheel can prove extremely difficult, if not impossible, on account of the bolts being locked tight, and in any case is awkward by being performed in critical conditions (traffic, poor lighting, bad weather). Considerable advantage is to be gained, therefore, by replacing the spare wheel with a repair and inflation kit comprising a small compressor and a container of sealing liquid, which can be stowed easily in a special compartment or in the boot of the car.

In addition to the big reduction in size and weight, puncture repair is also made faster and easier: as opposed to changing the wheel, the compressor is simply connected to a current outlet on the vehicle, the container of sealing liquid is connected to the compressor and to the valve of the tyre for repair, and the compressor is started to feed the liquid into the tyre. For this purpose, the container normally has a dispenser unit comprising an inlet conduit and an outlet conduit connected respectively, by respective conduits, to the compressor and the valve of the tyre for repair.

The container and the compressor are normally separate parts that must be connected prior to use, and which at most are housed for convenience inside the same holder.

This therefore involves additional work prior to use.

In one known solution, the container is fitted permanently to the dispenser unit, which incorporates a sealing device. The container, in itself open, is therefore undetachable from the dispenser unit.

Another drawback of this solution is that, when the use-by date of the sealing liquid expires, both the container and the dispenser unit must be replaced, thus increasing cost.

In another known solution, the container itself is sealed, e.g. by a sealing membrane, which is split when the container is fitted to the dispenser unit. This means also the dispenser unit must be fitted to the container just prior to use, thus making additional work.

DISCLOSURE OF INVENTION

It is an object of the present invention to provide a kit for repairing and inflating inflatable articles, designed to eliminate the aforementioned drawbacks typically associated with known kits.

According to the present invention, there is provided a kit for inflating and repairing inflatable articles, in particular, tyres; the kit comprising a compressor assembly, a container of sealing liquid, and connecting means for connecting the container to the compressor assembly and to an inflatable article for repair or inflation, and being characterized by comprising an outer casing housing said compressor assembly and defining a seat for the container of sealing liquid, said container being housed removably in said seat, and by comprising connecting means for stably connecting said container to said compressor assembly, so that the container, when housed in said seat, is maintained functionally connected to said compressor assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred, non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

FIG. **1** shows a view in perspective of a repair kit comprising a container of sealing liquid and in accordance with the present invention;

FIG. **2** shows a partly disassembled view in perspective of the FIG. **1** kit;

FIGS. **3** and **4** show a rear view and underside view in perspective respectively of the FIG. **1** kit partly disassembled;

FIGS. **5** and **6** show sections, along line V-V in FIG. **2**, of the container and a dispenser unit of the FIG. **2** kit assembled together;

FIG. **7** shows a schematic of a pneumatic circuit connected to the FIG. **2** kit dispenser unit.

BEST MODE FOR CARRYING OUT THE INVENTION

Number **1** in FIGS. **1** to **4** indicates as a whole a kit for fast repair of inflatable articles, in particular, tyres.

Kit **1** substantially comprises an electric compressor assembly **2**; a container **3** of sealing liquid; a first hose **4** connecting container **3** to compressor assembly **2**; and a second hose **5** connecting container **3** to a valve (not shown) of the tyre.

In known manner not shown, compressor assembly **2** comprises an electric motor and a compressor—powered by the electric motor—which are housed inside an outer casing **6**.

Casing **6** is substantially parallelepiped-shaped and, at one longitudinal end, defines a seat **7** for housing container **3** upside down. More specifically, seat **7** is bounded laterally by a substantially semicylindrical end wall **10** of casing **6**, and at the bottom by a circular base **14** projecting from end wall **10**.

Container **3** comprises a vessel **15**, preferably in the form of a bottle, containing the sealing liquid and having an externally threaded neck **16** defining an opening **17** (FIGS. **5** and **6**); and a valve device **18** housed in opening **17**. Valve device **18** forms an integral part of container **3**, to ensure the container is closed fluidtight when detached from the rest of kit **1**, as explained in detail below.

Valve device **18** comprises a body **19** having a cylindrical lateral wall **20**, of axis A, inserted in fluidtight manner inside neck **16**, and a portion **20***a* of which extends beyond neck **16**, into vessel **15**, and is closed at one end by an end wall **21**.

Portion **20***a* has two circumferential series of holes **24**, **25** communicating with the inside of vessel **15**, spaced axially apart, and located close to end wall **21** and close to neck **16** respectively.

Body **19** of valve device **18** also comprises an inner member **26** defined by a tubular rod **27** of axis A, and by a supporting ring **28** fixed inside an open end of body **19** and connected integrally to tubular rod **27** by a number of spokes **29** forming a number of axial passages **29***a*.

Rod **27** has a first end portion **27***a* close to end wall **21**, and a conveniently flanged second end portion **27***b* projecting axially outwards of body **19**, and defines internally an axial passage **27***c*.

Valve device **18** comprises a tubular slide **30**, which slides axially inside the annular chamber **36** formed between body **19** and rod **27**. Slide **30** is maintained in an axial stop position against end wall **21** by a helical spring **31** compressed axially between slide **30** and supporting ring **28**.

Slide **30** has a circumferential series of holes **32** formed at an outer annular groove **33** dividing the slide into two portions **37**, **38**. Slide **30** also comprises two pairs of outer, axially spaced sealing rings (O-rings) **34***a*, **34***b* and **35***a*, **35***b*, which are housed in respective annular seats and form a sliding seal between slide **30** and body **19**. The two pairs of O-rings **34***a*, **34***b* and **35***a*, **35***b* are located on axially opposite sides of holes **32**. More specifically, O-rings **34***a*, **34***b* are carried by portion **37** facing end wall **21**, and O-rings **35***a*, **35***b* are carried by portion **38** facing end portion **27***b* of rod **27**. In said axial stop position of slide **30**, O-ring **34***a* is located between holes **24** and end wall **21**; O-ring **34***b* is located between holes **24** and holes **32**; O-ring **35***a* is located between holes **25** and holes **32**; and O-ring **35***b* is located on the axially opposite side of holes **25** to O-ring **35***a*.

Portion **37** of slide **30** slides in fluidtight manner on rod **27**, preferably with the interposition of an O-ring **38***a* on rod **27**. Portion **38** of slide **30** is larger in inside diameter than rod **27**, and defines with rod **27** a chamber **39** open towards the flanged end portion **27***b* of rod **27** and communicating with holes **32**.

Kit **1** also comprises a dispenser unit **40**, which is housed stably but detachably inside a recess **44** in base **14** of casing **6**, and is connected detachably to container **3** to fit it, upside down, to casing **6** (FIGS. **1**, **5** and **6**).

More specifically, dispenser unit **40** substantially comprises a plug-like central portion **45** having a substantially cylindrical lateral wall **46** and an end wall **47**, which define an internally threaded cavity **48** into which neck **16** of vessel **15** is screwed; and a circular flange **68** extending radially from central portion **45** and defining a bayonet connection with corresponding fastening means **49** in base **14** of casing **6**.

Dispenser unit **40** also comprises a first tubular fitting **50** projecting radially from central portion **45** and defining a conduit **51** communicating with and radial with respect to a bottom portion **52** of cavity **48**; and a substantially pipe-like second tubular fitting **53** projecting radially, close to end wall **47** of central portion **45**, in a radial direction perpendicular to that of first tubular fitting **50**. Second tubular fitting **53** defines a conduit **54** communicating coaxially with bottom portion **52** of cavity **48**.

When container **3** is screwed into dispenser unit **40**, end portion **27***b* of tubular rod **27**—possibly fitted with an annular sealing member **69** on the end—cooperates in fluidtight manner with end wall **47** of central portion **45**, so that the internal axial passage **27***c* of rod **27** communicates with and substantially constitutes an extension of conduit **54** (FIGS. **5** and **6**).

Base **14** has lateral openings (one shown in FIG. **4**) through which fittings **50**, **53** are accessible from outside casing **6**, once dispenser unit **40** is bayonet connected inside recess **44** in base **14**, e.g. by rotating it 45° with respect to the FIG. **2** insertion position.

First fitting **50** is connected to hose **5**, which, when not in use, may be wound about the casing and housed inside a peripheral groove **56** in the casing; and second fitting **53** is connected to compressor **2** by hose **4**. Conveniently, hose **4** is longer than required for connection to fitting **53**, and is fitted on its free end with a fast-fit, e.g. lever-operated, coupling **58**. Hose **4** is therefore normally connected to second fitting **53**, but can be detached easily and connected directly to the article, e.g. a tyre, ball, dinghy, etc., if this simply needs inflating and not repair. Hose **4** is normally stowed almost entirely inside a seat **59** formed on the underside of casing **6**, from which it extends along an underside groove **60** housing the end portion of hose **4** fitted with coupling **58**.

Second fitting **53** is located at a different height from first fitting **50**, so as to avoid any interference with hose **5** wound about casing **6**.

Compressor assembly **2** has an electric power cable **61** fitted on the end with a connector **62** for connection to a current outlet on the vehicle. Cable **61** is normally housed in a seat **63** formed in a portion of casing **6** opposite seat **7** for container **3**, and connector **62** is stowed inside a cavity **64** in seat **63**. Compressor assembly **2** is conveniently provided with a gauge **65** and a switch **66**.

Kit **1** and particularly container **3** operate as follows.

Kit **1** is an integrated preassembled unit, which is supplied ready for use as shown in FIG. **1**.

To repair an inflatable article, e.g. a tyre, hose **5** is simply connected to the tyre valve, and compressor assembly **2** activated.

The air pressure along hose **4**, fitting **50**, and internal passage **27***c* of rod **27**, is transmitted to the end of annular chamber **36**, and exerts thrust on the end surface of slide **30** adjacent to end wall **21**.

Slide **30** therefore moves, in opposition to spring **31**, from the FIG. **5** rest position to the FIG. **6** position, in which O-rings **34***a*, **34***b* are interposed between holes **24** and holes **25**, and O-ring **35***a* has moved past holes **25**, so that holes **32** in slide **30** communicate with holes **25**. Compressed air therefore flows through holes **24** into container **3**, which is therefore pressurized, so that sealing liquid flows through holes **25** and holes **32** into chamber **39** in slide **30**, and is fed along fitting **50** and hose **5** to the tyre.

Device **18** therefore acts as a two-way, two-position, pneumatic valve. In the closed position (FIG. **5**), the container is sealed; with pressure along the feed line defined by hose **4**, device **18** opens automatically to allow compressed air into container **3**, and simultaneous outflow of sealing liquid.

The advantages of kit **1** according to the present invention will be clear from the foregoing description.

In particular, kit **1** is a compact, integrated unit that can be stowed ready for use, with no additional work required, other than connection to the vehicle electric system and to the tyre.

Container **3** with an integrated valve device **18** constitutes an independent sealed unit, regardless of whether or not it is connected to dispenser unit **40**.

After use, or when the sealing liquid use-by date expires (normally after a few years), only container **3** need be replaced. That is, dispenser unit **40** need not be replaced, and may be left permanently inside casing **6**.

Using a two-way valve device **18** closed stably in the absence of pressure along the feed line **4**, sealing liquid leakage is prevented, even in abnormal conditions, such as overpressure in container **3** caused by high temperature inside the boot of a car parked in the sun.

Using a valve device **18**, container **3** is ready for use at all times, i.e. fitted permanently to kit **1**. Container **3**, in fact, is sealed but operated immediately in response to turning on the compressor.

Unit **40** is preferably detachable from casing **6** and carried by container **3**.

Clearly, changes may be made to kit **1** as described herein without, however, departing from the scope of the accompanying Claims.

In particular, FIG. **7** shows a diagram of a pneumatic sealing liquid dispensing circuit **80** comprising a three-way, three-position valve **81**, a conduit **82** connected to second fitting **53**, and an additional hose **83** connectable to the tyre. Valve **81** is input connected to the compressor of compressor assembly **2**, and is output connected to conduit **82** and additional hose **83**.

Valve **81** is controlled by a hand-operated selector **85** located on casing **6** and cooperating with an on-switch **86** of compressor assembly **2**. In use, selector **85** defines a disabling position, in which on-switch **86** is disabled and compressor assembly **2** cannot be started, thus preventing it from being turned on accidentally; and a first and second enabling position, in which on-switch **86** is enabled to start the compressor. More specifically, in the first enabling position, valve **81** is switched automatically to connect the compressor to dispenser unit **40** via second fitting **53** and disconnect additional hopes **83**; and, in the second enabling position, valve **81** is switched automatically to connect the compressor to additional hose **83** and disconnect dispenser unit **40**. Additional hose **83** is housed in casing **6**, and enables compressor assembly **2** to be used quickly and easily to inflate a flat tyre.

Pneumatic circuit **80** and hose **5** may also be connected to one or more hand-operated relief valves **87**, to prevent overpressure in conduit **82** and hoses **5** and **83**, or, when the compressor is off, to accurately adjust the pressure of the inflatable article as required.

The end of hose **5** connected to the tyre may be fitted with a non-return valve, to prevent sealing liquid leakage when hose **5** is detached from the tyre.

Container **3** may also be connected to casing **6** by a click-on coupling acting in a direction parallel to axis A.

The invention claimed is:

1. A kit for inflating and repairing inflatable articles; the kit comprising a compressor assembly (**2**), a container (**3**) of sealing liquid, and connecting means (**4**, **5**) for connecting the container to the compressor assembly (**2**) and to an inflatable article for repair or inflation, and being characterized by comprising an outer casing (**6**) housing said compressor assembly (**2**) and defining a seat (**7**) for the container (**3**) of sealing liquid, said container (**3**) being housed removably in said seat (**7**), and by comprising container connecting means (**4**, **40**) for stably connecting said container to said compressor assembly (**2**), so that the container, when housed in said seat (**7**), is maintained functionally connected to said compressor assembly (**2**), said kit further comprising an additional hose (**83**) cooperating with said inflatable article; and a three-way valve (**81**) input connected to said compressor assembly (**2**), and output connected to said container (**3**) and to said additional hose (**83**) to direct a stream of compressed air selectively to said container (**3**) or to said additional hose (**83**).

2. A kit as claimed in claim **1**, characterized in that said connecting means comprise a compressed-air feed line (**4**) for feeding compressed air from said compressor assembly (**2**) to said container (**3**); said container (**3**) comprising a vessel (**15**) having an opening (**17**), and a valve device (**18**) fitted in fluid-tight manner to the opening (**17**) and having an inlet (**27***c*) connectable to said compressed-air feed line (**4**), and an outlet (**29***a*) for the sealing liquid.

3. A kit as claimed in claim **2**, characterized in that said valve device (**18**) comprises at least one control member (**30**) movable, in response to pressurization of said compressed-air feed line (**4**), from a closed position, closing said valve device (**18**) and in which said inlet (**27***c*) and said outlet (**29***a*) are isolated from the inside of said container (**3**), to an open position in which said inlet (**27***c*) and said outlet (**29***a*) communicate with the inside of said container (**3**).

4. A kit as claimed in claim **3**, characterized in that said valve device (**18**) comprises elastic means (**31**) for keeping said control member (**30**) stably in said closed position in the absence of pressure to said inlet (**27***c*).

5. A kit as claimed in claim **2**, characterized in that said container connection means comprise dispenser unit (**40**) connectable detachably to said container (**3**) and having an inlet fitting (**53**) connected in fluid-tight manner to said inlet (**27***c*) of said valve device (**18**), and an outlet fitting (**50**) connected in fluid-tight manner to said outlet (**29***a*) of said valve device (**18**).

6. A kit as claimed in claim **5**, characterized in that said dispenser unit is detachable from said casing.

7. A kit as claimed in claim **6**, characterized in that said seat (**7**) comprises a base portion (**14**) having fast-fit fastening means (**49**) by which to secure said dispenser unit (**40**) to said casing (**6**).

8. A kit as claimed in claim **7**, characterized in that said fastening means (**49**) comprise a bayonet connection.

9. A kit as claimed in claim **7**, characterized in that said fastening means comprise a fast-fit click-on coupling.

10. A kit as claimed in claim **5**, characterized in that said dispenser unit (**40**) comprises a cavity (**48**) to which is fitted a neck (**16**) of said container (**3**) in an upside down position; said neck (**16**) defining said opening (**17**).

11. A kit as claimed in claim **1**, characterized in that said three-way valve (**81**) is controlled by a selector (**85**) which can be set to a disabling position, in which operation of said compressor assembly (**2**) is disabled; to a first enabling position, in which operation of said compressor assembly (**2**) is enabled, and said container (**3**) is connected fluidically to said compressor assembly (**2**); and to a second enabling position, in which operation of said compressor assembly (**2**) is enabled, and said additional hose (**83**) is connected fluidically to said compressor assembly (**2**).

12. A kit as claimed in claim **11**, characterized in that said connecting means comprise a compressed-air feed line (**4**) for feeding compressed air from said compressor assembly (**2**) to said container (**3**); said container (**3**) comprising a vessel (**15**) having an opening (**17**), and a valve device (**18**) fitted in fluid-tight manner to the opening (**17**) and having an inlet (**27***c*) connectable to said compressed-air feed line (**4**), and an outlet (**29***a*) for the sealing liquid.

13. A kit as claimed in claim **12**, characterized in that said valve device (**18**) comprises at least one control member (**30**) movable, in response to pressurization of said compressed-air feed line (**4**), from a closed position, closing said valve device (**18**) and in which said inlet (**27***c*) and said outlet (**29***a*) are isolated from the inside of said container (**3**), to an open position in which said inlet (**27***c*) and said outlet (**29***a*) communicate with the inside of said container (**3**).

14. A kit as claimed in claim **13**, characterized in that said valve device (**18**) comprises elastic means (**31**) for keeping said control member (**30**) stably in said closed position in the absence of pressure to said inlet (**27***c*).

15. A kit as claimed in claim **11**, characterized in that said container connection means comprise dispenser unit (**40**)

connectable detachably to said container (**3**) and having an inlet fitting (**53**) connected in fluid-tight manner to said inlet (**27***c*) of said valve device (**18**), and an outlet fitting (**50**) connected in fluid-tight manner to said outlet (**29***a*) of said valve device (**18**).

16. A kit as claimed in claim **15**, characterized in that said dispenser unit is detachable from said casing.

17. A kit as claimed in claim **16**, characterized in that said seat (**7**) comprises a base portion (**14**) having fast-fit fastening means (**49**) by which to secure said dispenser unit (**40**) to said casing (**6**).

18. A kit as claimed in claim **17**, characterized in that said fastening means (**49**) comprise a bayonet connection.

19. A kit as claimed in claim **17**, characterized in that said fastening means comprise a fast-fit click-on coupling.

20. A kit as claimed in claim **15**, characterized in that said dispenser unit (**40**) comprises a cavity (**48**) to which is fitted a neck (**16**) of said container (**3**) in an upside down position; said neck (**16**) defining said opening (**17**).

21. A kit as claimed in claim **11**, characterized in that at least one of said connecting means (**4**) and said additional hose (**83**) is connected to a relief valve (**87**).

22. A kit as claimed in claim **11**, characterized in that said connecting means (**5**) comprise a non-return valve.

23. A kit as claimed in claim **1**, characterized in that at least one of said connecting means (**4**) and said additional hose (**83**) is connected to a relief valve (**87**).

24. A kit as claimed in claim **1**, characterized in that said connecting means (**5**) comprise a non-return valve.

25. A kit as claimed in claim **1** wherein said additional hose (**83**) when not in use is housed in a peripheral groove (**56**) at least partly surrounding the outer casing (**6**).

26. A kit for inflating and repairing inflatable articles; the kit comprising a compressor assembly, a container of sealing liquid, and conduits connecting the container to the compressor assembly and to an inflatable article for repair or inflation, said kit further comprising an outer casing housing said compressor assembly and defining a seat for the container of sealing liquid, said container being housed removably in said seat, and additionally comprising a container connecting conduit connecting said container to said compressor assembly, so that the container, when housed in said seat, is maintained functionally connected to said compressor assembly, said kit further comprising an additional hose cooperating with said inflatable article; and a three-way valve input connected to said compressor assembly, and output connected to said container and to said additional hose to direct a stream of compressed air selectively to said container or to said additional hose.

27. The kit as claimed in claim **26** wherein at least one of said conduits connecting the container to the compressor assembly and said container connecting comprises a hose.

28. A kit as claimed in claim **26** wherein said three-way valve is controlled by a selector which can be set to a disabling position, in which operation of said compressor assembly is disabled; to a first enabling position, in which operation of said compressor assembly is enabled, and said container is connected fluidically to said compressor assembly; and to a second enabling position, in which operation of said compressor assembly is enabled, and said additional hose is connected fluidically to said compressor assembly.

29. A kit as claimed in claim **26**, wherein said valve device comprises at least one control member movable, in response to pressurization of said compressed-air feed line, from a closed position, closing said valve device and wherein said inlet and said outlet are isolated from the inside of said container, to an open position in which said inlet and said outlet communicate with the inside of said container (**3**).

30. A kit as claimed in claim **26**, wherein said valve device comprises a spring for keeping said control member stably in said closed position in the absence of pressure to said inlet.

31. A kit as claimed in claim **26** wherein said additional hose when not in use is housed in a peripheral groove at least partly surrounding the outer casing.

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