

[54] **APPARATUS FOR BLEEDING METERED INCREMENTS OF A COMPRESSED GAS FROM A CONTAINER**

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[58] **Field of Search** 137/204, 228, 229, 317, 137/320, 321, 322, 329.1, 329.2, 329.3, 329.4, 627.5; 251/318, 319, 320, 321, 322, 323, 330, 339; 222/188, 387, 389, 397, 450, 453

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[57] ABSTRACT

Metered increments of a gas under superatmospheric pressure are bled from a container equipped with a nipple and a valve in the nipple normally closed by the gas pressure in the container into a vessel equipped with a receptacle matching the nipple and a rod which can be shifted manually into a bleeding position in which it enters the receptacle and the nipple therein to open the valve and to admit gas to the vessel cavity through the receptacle while another opening, leading from the cavity to the ambient atmosphere, is sealed by a valve ring on the rod. Gas pressure in the cavity tends to move the rod from its bleeding position outward of the receptacle into a venting position in which it permits the valve on the container to close, and the valve ring permits compressed gas to be vented to the atmosphere from the vessel cavity.

9 Claims, 2 Drawing Figures

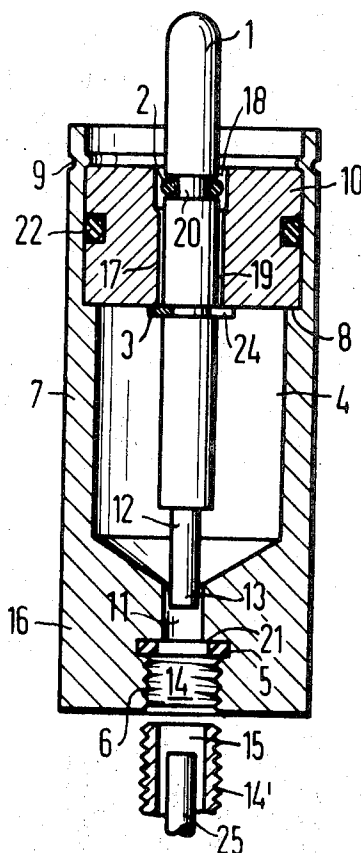


Fig. 1

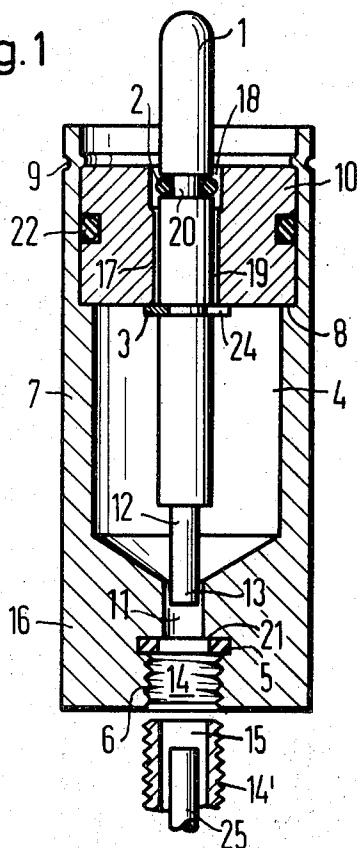
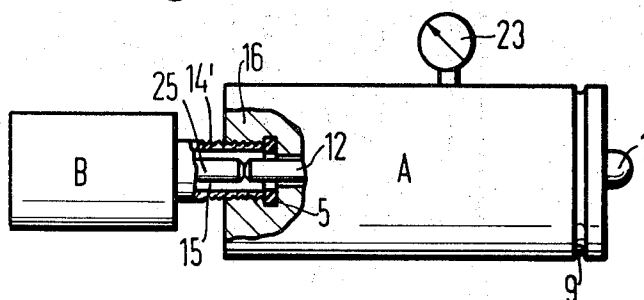


Fig. 2



APPARATUS FOR BLEEDING METERED INCREMENTS OF A COMPRESSED GAS FROM A CONTAINER.

This invention relates to pressure adjustment in containers holding a gas under superatmospheric pressure, and particularly to apparatus for bleeding metered increments of a compressed gas from a container.

It is normal practice in the manufacture of hydro-pneumatic shock absorbers for automotive vehicles to charge the otherwise completed shock absorbers with more than the required amount of air or nitrogen from a pressure tank or line, and thereafter to release the excess gas by repeatedly opening a bleeding valve in a connector and checking the residual pressure after each partial release of excess gas. While a very experienced worker can reach the desired pressure in only a few cycles of pressure release and measurement, the procedure is usually time-consuming, and its cost is significant.

The primary object of the invention is the provision of apparatus which permits precisely identical volumes of gas to be released in each bleeding step, thereby permitting the desired pressure to be reached in a readily predictable manner with fewer measurements being needed.

With this object and others in view, the invention, in its more specific aspects, provides a vessel whose rigid walls bound a cavity of fixed volume. A receptacle on the vessel communicates with the cavity and is shaped to receive the connector on the shock absorber or other container that it is desired to relieve of gas under superatmospheric pressure in gas-tight engagement while the bleeding valve in the connector is closed and while it is open. A venting valve on the vessel is movable between an open position in which it connects the cavity of the vessel to the ambient atmosphere and a closed position.

A manually operable valve actuating member is mounted on the vessel for movement between a bleeding position and a venting position. It is connected with the venting valve for moving the same from the open to the closed position when the actuating member moves from the venting to the bleeding position, and the venting valve is moved from the closed to the open position when the actuating member moves from the bleeding position to the venting position. When in the bleeding position, the valve actuating member extends into the afore-mentioned receptacle for opening the bleeding valve of a connector received in the receptacle.

Other features and many of the attendant advantages of this invention will readily be appreciated as the same becomes better understood by reference to the following detailed description of a preferred embodiment when considered in connection with the appended drawing in which:

FIG. 1 shows bleeding apparatus and the connector of a container to be bled thereby according to this invention in elevational section; and

FIG. 2 shows the devices of FIG. 1 in elevation, and partly in section, in the connected condition.

Referring now to the drawing in detail, and initially to FIG. 1, there is shown a cylindrical vessel whose axial wall 7 is integral with a heavy bottom wall 16 closing the cavity 4 of the vessel in one axial direction except for an axial, central opening 11 of circular cross section. A portion of the wall 16 provides the walls of

a receptacle 14 which forms the enlarged orifice of the opening 11. A radial shoulder 21 in the receptacle 14 is covered by a resilient sealing ring 5, and the axial wall of the receptacle 14 carries female threads 6.

The receptacle 14 is shaped for gas-tight engagement with an externally threaded nipple 14' on a hydropneumatic shock absorber, not otherwise shown in detail. The operating pin 25 of a valve normally biased toward the closed position by internal pressure in the shock absorber is coaxially arranged with ample clearance in the bore 15 of the nipple 14'. The valve, not itself shown, is of the type well known from the tires of any automobile or bicycle, and it is opened when the pin 25 is pushed inward of the nipple 14'.

The radial top wall of the vessel is formed by an annular plug 10 axially secured in the wall 7 between an integral shoulder 8 of the latter and a circular, circumferential rib formed in the wall 7 by rolling a groove 9 into its outer face after insertion of the plug 10. An O-ring 22 in an annular groove of the plug 10 seals the plug to the inner face of the wall 7. The plug 10 has an axial, central bore of stepped cylindrical shape. The outer bore portion 18 has a greater cross section than the inner portion 17.

A straight rod having a heavier cylindrical portion 1 and a reduced, cylindrical portion 12 is coaxially guided in the bore of the plug 10 and in the opening 11 whose cross section is smaller than that of the inner bore portion 17, but greater by a clearance 13 than that of the rod portion 12. A circumferential groove 20 in the rod portion 1 receives a valve ring 2 of toroidal shape and elastomeric material so dimensioned that its cross section in the illustrated relaxed condition is smaller than that of the outer bore portion 18 in which it is received in the illustrated or venting position of the actuating rod, but greater than that of the inner bore portion 17.

The spherically rounded end of the rod portion 1 projects axially from the vessel in the illustrated position as far as abutment of a spring clip 3 against the wall of the plug 10 in the cavity 4 permits. The clip is of the conventional approximate C-shape so that an opening 24 in the clip connects the cavity 4 with an annular gap 19 between the plug 10 and the rod portion 1 in the bore 17 and thus with the ambient atmosphere in the illustrated position of the clip 3.

A pressure gage 23 is mounted on that portion of the wall 7 which is cut away in the view of FIG. 1. It is shown in FIG. 2 and communicates with the cavity 4 in an obvious manner, not specifically illustrated.

In assembling the bleeding apparatus, the clip 3 and valve ring 2 are mounted on the rod portion 1 before the rounded end of the latter is inserted into the bore portion 17 of the plug 10. The latter is then placed in the open end of the container 7, 16, free of the groove 9 at this stage, until the plug abuts against the shoulder 8, the reduced end 12 of the actuating rod being guided toward the opening 11 by the conically tapering inner face of the wall 16. The groove 9 is rolled into the wall 7, and the sealing ring 5 is inserted into the receptacle 14.

As is shown in FIG. 2, the bleeding apparatus, generally designated A, is operated by first engaging the external threads on the nipple 14' of a shock absorber B with the threads 6 until the free end of the nipple 14' sealingly engages the disc 5. The rounded end of the rod portion 1 is then pushed manually inward of the

cavity 4, whereby the sealing ring 2 is caused to enter the narrower bore portion 17 and to seal the cavity 4 from the atmosphere. The reduced rod portion 12 thereafter enters the receptacle 14 and the bore 15 of the nipple 14', ultimately depressing the pin 25 of the normally closed valve, not otherwise shown, on the shock absorber B. Gas flows from the latter into the cavity 4 until pressure equilibrium is reached.

The cavity 4 now contains a precisely defined volume of gas at a pressure which may be read from the gage 23. The gas pressure in the bleeding apparatus biases the rod portion 1 outward of the bore 18, and the rod is returned to the position illustrated in FIG. 1, if manual pressure on its projecting end is relaxed. The valve pin 25 returns to its sealing position, the cavity 4 is vented to the atmosphere, and the apparatus is ready for another bleeding operation. If so desired, the gage 23 may be calibrated in numbers of bleeding cycles required for reducing the pressure in a shock absorber of standardized structure and dimensions from the pressure prevailing after the first bleeding to a design pressure so that the operator need only depress the rod portion 1 as often as a first gage reading indicates. The gage, of course, also may be calibrated in units of pressure, and the rod end depressed repeatedly until the gage reading after bleeding drops to the desired value. A precisely equal volume of gas is bled from the shock absorber B in each operating cycle so that an operator may adjust the shock absorber to a precise internal pressure by a fixed number of bleeding cycles if the starting pressure is held uniform. The gage 23 is unnecessary under such conditions. The bleeding operation is completed very quickly.

While the bleeding device of the invention has been described with reference to pressure adjustment in a hydropneumatic shock absorber, and the specific embodiment illustrated has dimensions and structural features suitable for withstanding the very high gas pressures encountered in such service, the invention is not limited to the specific application for which it was originally intended, and other fields of use readily present themselves, such as the charging of a mechanical refrigeration system with a normally gaseous refrigerant and the inflation of tires from a compressed air line not equipped with a pressure limiting valve. The necessary changes in the configuration of the receptacle 14 and other details will readily suggest themselves to those skilled in the art.

It should be understood, therefore, that the foregoing disclosure relates only to a preferred embodiment of the invention, and that it is intended to cover all changes and modifications of the example of the invention herein chosen for the purpose of the disclosure which do not constitute departures from the spirit and scope of the invention set forth in the appended claims.

What is claimed is:

1. Apparatus for establishing a predetermined, super-atmospheric pressure in a body of gas comprising, in combination: a. a container adapted to receive said body; b. a connector extending outward from said container; c. a first valve movable in said connector between an open position and a closed position, said valve being biased toward said closed position when said body of gas is received in said container; d. a vessel having rigid walls and bounding a cavity of fixed volume; e. receptacle means on said vessel for releasably

receiving said connector in gas-tight engagement; f. a second valve on said vessel movable between an open position on which said second valve connects said cavity to the ambient atmosphere and a closed condition; and g. a manually operable valve actuating member mounted on said vessel for movement between a bleeding position and a venting position, 1. said actuating member being connected to said second valve for moving the same from the open to the closed position thereof when said actuating member moves from the venting to the bleeding position, and for moving said second valve from the closed to the open position when said actuating member moves from the bleeding position to the venting position, 2. said valve actuating member, when said connector is received in said receptacle means, engaging said first valve and moving said first valve from the closed position to the open position of said first valve when said actuating member moves from said venting to said bleeding position.

2. Apparatus as set forth in claim 1, wherein two of said walls are formed with respective openings therethrough, one of said openings connecting said cavity with the ambient atmosphere, and the other opening connecting said cavity with said receptacle means, respective portions of said actuating member being received in said openings in at least one of said positions of said actuating member, said second valve including a valve member mounted on one of said portions of said actuating member and sealing said one opening in said bleeding position of the actuating member.

3. Apparatus as set forth in claim 2, wherein the other portion of the actuating member is received in said other opening with sufficient clearance to permit the flow of gas from said receptacle to said cavity in said bleeding position of the actuating member and being of smaller cross section transverse to the direction of movement of said actuating member than said one portion, whereby superatmospheric gas pressure in said cavity biases said one portion to move outward of said cavity through said one opening.

4. Apparatus as set forth in claim 3, wherein said one portion of the actuating member projects outward of said vessel in said bleeding position thereof.

5. Apparatus as set forth in claim 3, further comprising abutment means on said actuating member for limiting outward movement of said actuating member from said cavity through said one opening by abutting engagement in said cavity with the wall formed with said one opening.

6. Apparatus as set forth in claim 2, wherein said one opening has an inner portion adjacent said cavity and an outer portion offset from said inner portion toward said ambient atmosphere, said valve member being annular and of yieldably resilient material, said inner portion having a cross section smaller than the cross section of said valve member in the relaxed condition thereof and receiving said valve member in the bleeding position of said actuating member, and said outer portion having a cross section greater than said cross section of said valve member and receiving the valve member in said venting position of the actuating member.

7. Apparatus as set forth in claim 6, wherein the cross section of said one portion of the actuating member is smaller than the cross section of said inner portion, said one portion bounding a gap in said one opening in the

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venting position thereof for venting said cavity to the atmosphere.

8. Apparatus as set forth in claim 1, wherein an integral portion of one of said walls constitutes said receptacle and is formed with an opening connecting said cavity to said receptacle, said valve actuating member

passing through said opening with clearance when in said bleeding position thereof.

9. Apparatus as set forth in claim 1, further comprising a pressure gage mounted on said container and communicating with said cavity.

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