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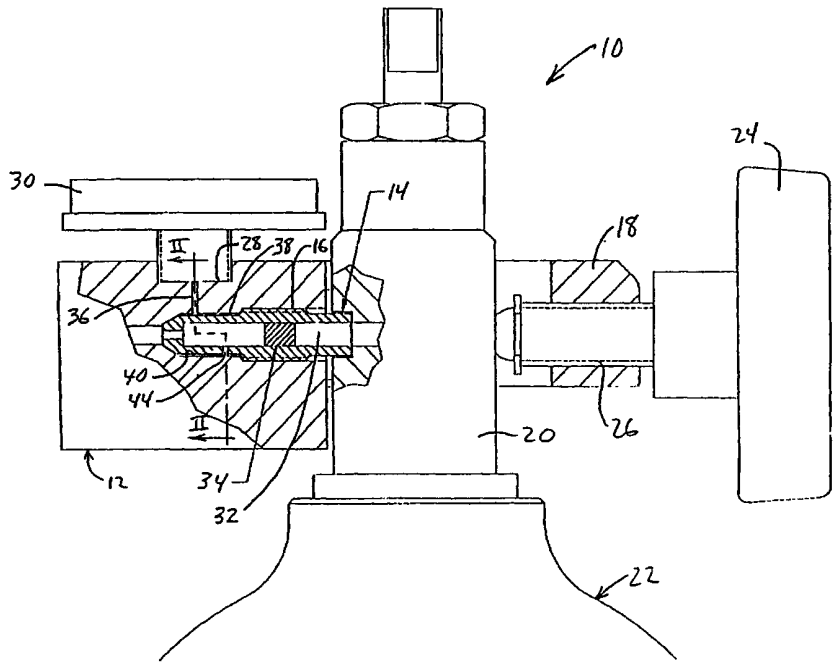
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(54) Title: ASSEMBLY FOR REDUCING CONTAMINATION IN HIGH PRESSURE GAS REGULATOR DEVICES



(57) Abstract: A regulator module assembly (10, 110) for delivering high pressure respiratory gas from a source of such gas (22) to a recipient, the assembly (10, 110) comprising an insert (14, 114) for effectively preventing contamination of the regulator module assembly (10, 110) by a pressure gauge (30) connected to the assembly (10, 110) and arising from removal and replacement of the pressure gauge (30).

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ASSEMBLY FOR REDUCING CONTAMINATION IN HIGH PRESSURE GAS REGULATOR DEVICES

Field of the Invention

The present invention relates in general to apparatus for delivering pressurized gases and, in particular, to apparatus for delivering pressurized respiratory gases.

Background of the Invention

Many medical patients suffering from any of a variety of lung ailments are often prescribed supplemental oxygen or other respiratory therapy so that the patient can breath air enriched with oxygen or other therapeutic respiratory gas throughout the day and sometimes throughout the night. Typical supplemental oxygen therapy employs a nasal cannula system or a nasal/facial mask system operably connected between a cylinder or tank of compressed oxygen and the patient's nose. In earlier developed treatment therapies, oxygen was continuously delivered to the patient throughout the patient's entire breathing cycle. However, this method of continuously delivering oxygen to the patient was wasteful because much of the oxygen dissipated into the ambient air environment. Better methods of delivering oxygen to the patient were later developed which included improved equipment that would only deliver oxygen to the patient during the inhalation phase of the patient's breathing cycle. Usually, this improved equipment employed a demand valve which opened to deliver supplemental oxygen to the patient only when the patient inhaled. Numerous types of demand valves are well known in the prior art.

The source of pressurized respiratory gas is usually a cylinder or tank containing a supply of oxygen or other respiratory gas such as nitrous oxide or the like under high pressure which is typically discharged at a pressure of between about 200-3000 psi. The cylinder or tank usually includes an upright post valve which is insertable into a yoke of the regulator module. The regulator module is used to control the pressure and flow rate of gas

delivered from the source of pressurized gas to the patient or recipient. The regulator module includes a pressure gauge and an internal or external high pressure regulator for reducing the gas pressure from the source of pressurized gas to about 50–80 psi. The regulator module further preferably includes a suitable relief valve such as a check valve, poppet valve or the like, operable to release excess gas pressure above about 90 psi in the event of failure of the high pressure regulator, which pressure might otherwise cause malfunction and/or damage to the high pressure regulator or other components of the respiratory apparatus.

Existing high pressure regulator constructions are susceptible to contamination from dust, dirt or other debris that enters the regulator module when the pressure gauge itself is contaminated or when the pressure gauge is removed and replaced by a new regulator. Contamination from the pressure gauge may deleteriously affect gas flow through the regulator module or otherwise negatively impact performance of the regulator module.

Presently known high pressure regulators routinely protect the regulator module from contamination that might occur at the regulator module/cylinder connection. More particularly, a filter is disposed in the gas flow path that provides fluid communication between the pressurized respiratory gas cylinder and the regulator module. The filter is generally made of sintered bronze or stainless steel and is placed in close proximity to the cylinder connection with the regulator module. The filter is normally held in a nozzle-like metal insert which may also act as the required diametrical seal interface for the gas cylinder. Frequently, the insert is threaded into the regulator module.

In presently known regulator modules, the pressure gauge is connected to the regulator module such that the pressure gauge communicates with the gas flow path linking the pressurized respiratory gas cylinder with the regulator module. Unlike the connection between the gas cylinder and the regulator module, however, the connection between the pressure gauge and the regulator module normally is not adequately

protected from ingress of contamination into the regulator module. For example, some regulator designs provide no filtration whereas others incorporate thin screens disposed between the pressure gauge and the regulator module. Such screens may be easily torn or punctured by the pressure gauge, or may become dislodged and lost, when a gauge is removed or replaced.

An advantage exists, therefore, for a regulator module for high pressure respiratory gas delivery apparatus including means for effectively preventing contamination of a regulator module by the pressure gauge or arising from removing or replacing the pressure gauge. Such means should also be disposed in the regulator module such that it cannot be damaged by the pressure gauge or dislodged and lost when the pressure gauge is removed or replaced.

Summary of the Invention

The present invention provides a regulator module assembly for delivering high pressure respiratory gases from at least one source of such gases to a recipient/patient. The assembly includes means for effectively preventing contamination of the regulator module by the pressure gauge or arising from removal and/or replacement of the pressure gauge. The contamination prevention means is disposed in the regulator module such that it cannot be damaged by the pressure gauge or dislodged and lost when the pressure gauge is removed or replaced.

According to presently preferred embodiments, the contamination prevention means include either a one-part or two-part insert means, preferably fabricated from metal, that communicates with the pressure gauge and which establishes a gas flow path between the high pressure respiratory gas cylinder and the regulator module. The insert means preferably acts as the required diametrical seal interface for the gas cylinder and, desirably, is threaded into the regulator module. According to at least one preferred embodiment, a filter is disposed in the insert means in the gas

flow path that provides fluid communication between the pressurized respiratory gas cylinder and the regulator module. The filter is preferably made of sintered bronze or stainless steel. The insert means is constructed and arranged such that it creates a circuitous flow path between the pressure gauge and the gas flow path between the high pressure gas cylinder and the regulator module, thereby preventing contamination from the pressure gauge to enter that gas flow path. Moreover, the insert means is disposed internally of the regulator module in such a way that it cannot become displaced or lost when the pressure gauge is removed or replaced.

Other details, objects and advantages of the present invention will become apparent as the following description of the presently preferred embodiments and presently preferred methods of practicing the invention proceeds.

Brief Description of the Drawings

The invention will become more readily apparent from the following description of preferred embodiments thereof shown, by way of example only, in the accompanying drawings, wherein:

FIG. 1 is a partial cross-sectional view, in elevation, of a first presently preferred embodiment of a regulator module assembly according to the present invention shown connected to the post valve of a conventional high pressure gas cylinder;

FIG. 2 is a sectional view taken along line II-II of FIG. 1; and

FIG. 3 is a view similar to FIG. 1 of a further presently preferred embodiment of a regulator module assembly according to the present invention.

Detailed Description of the Invention

Turning to the drawings wherein like references indicate like elements throughout the several views, in FIG. 1 there is shown a regulator module assembly constructed in accordance with a first embodiment of the present

invention. The assembly, identified generally by reference numeral 10, comprises a regulator module housing 12 and insert means 14. In assembly 10, insert means 14 is preferably fabricated as a unitary or one-part metal insert that is preferably threadedly received at 16 in regulator module housing 12. The regulator module housing includes a yoke portion 18 sized and shaped to accommodate an upright post valve 20 of a conventional high pressure gas cylinder 22 that may contain pressurized oxygen, nitrous oxide or other respiratory gas typically at a pressure of between about 200-3000 psi. As is conventional, actuation and deactuation of the post valve 20 is preferably achieved via a rotatable handle 24 that is threadedly received at 26 in yoke portion 18.

Regulator module assembly 10 further includes means 28 such as a socket or the like for receiving a pressure gauge 30 that may be threadedly or otherwise releasably connected to regulator module housing 12 by any suitable means known in the art.

Insert means 14 establishes a gas flow path 32 between the high pressure gas cylinder 22 and the regulator module housing 12. Insert means 14 preferably acts as the required diametrical seal interface for the gas cylinder 22. A filter 34 is preferably disposed in insert means 14 in gas flow path 32 to prevent contamination that might occur at the connection of regulator module housing 12 and cylinder 22. Filter 34 is preferably made of sintered bronze or stainless steel. Pressure gauge 30 communicates with gas flow path 32 via a passageway 36. In both presently preferred embodiments of the invention disclosed herein, the insert means is constructed and arranged such that it creates a circuitous flow path between the pressure gauge 30, passageway 36 and gas flow path 32, thereby minimizing the likelihood that contamination from the pressure gauge might enter gas flow path 32. Moreover, the insert means is disposed internally of the regulator module housing 12 in such a way that it cannot become displaced or lost when the pressure gauge 30 is removed or replaced. In both embodiments, the insert means is spaced from the pressure gauge by

virtue of passageway 36 and thus cannot be damaged by the pressure gauge. In addition, the insert means is too large to pass through passageway 36 and thus cannot become dislodged for the regulator module housing 12 when the pressure gauge is removed or replaced.

According to the presently preferred embodiments, the circuitous flow path is achieved by indirectly communicating gas flow path 32 with passageway 36. That is, insert means 14 is preferably fabricated and disposed in regulator module housing 12 such that no port, orifice or other opening means in gas flow path 32 lies in direct alignment with passageway 36. Preferably, any opening means communicating gas flow path 32 with passageway 36 is either axially or radially spaced or, more preferably, both axially and radially spaced from passageway 36.

As most clearly shown in FIG. 2, insert means 14 includes a projecting portion 38 adapted for insertion into a cavity 40 provided in regulator module housing 12. However, the outer circumferential dimensions of portion 38 are slightly less than the circumferential dimensions of cavity 40 whereby an annulus 42 is formed between portion 38 and cavity 40 when insert means 14 is installed in housing 12. Insert means 14 includes opening means in the form of at least one port 44 which communicates gas flow path 32 with annulus 42. Port 44 is preferably up to 180° out of alignment with passageway 36 such that pressurized gas exiting port 44 must angularly traverse annulus 42 before entering passageway 36 to be monitored for its pressure level by pressure gauge 30. Preferably, as shown in FIG. 2, port 44 is also axially spaced with respect to passageway 36. In this way, pressurized gas exiting port 44 must also axially traverse annulus 42 before entering passageway 36. The circuitous flow path so created between port 44 and passageway 36 thus greatly reduces the likelihood that the regulator module might become contaminated by either a contaminated pressure gauge or from environmental dust or debris when the pressure gauge is removed or replaced.

FIG. 3 depicts a regulator module assembly constructed in accordance with a second embodiment of the present invention and identified generally by reference numeral 110. The elements of assembly 110 that bear like or similar reference numerals to elements of other apparatus discussed hereinabove may be considered structurally and functionally equivalent to their counterparts in those Figures and thus will not be described in detail in connection with FIG. 3 except where necessary to provide a proper understanding of the invention.

Assembly 110 comprises insert means 114 preferably fabricated as a two-part metal member including a first part 114a and a second part 114b. First part 114a is preferably received at one end by friction fit or threading in regulator module housing 12. At its opposite end, first part 114a is received with sufficient clearance or tolerance in second part 114b to establish annulus 42 therebetween. Second part 114b is preferably threadedly received at 16 in regulator module housing 12 and sealed with regard to the housing 12 by an O-ring 46. The opening means in the two-part insert means 114 which communicates gas flow path 32 with annulus 42 is established by a gap 48 located between the first and second parts 114a, 114b. Gap 48, like port 44 of FIGS. 1 and 2, is preferably axially spaced a substantial distance from passageway 36 to optimize the contamination-preventive characteristics of assembly 110.

Claims

1. A regulator module assembly for delivering high pressure respiratory gas from a source of such gas to a recipient, the assembly comprising means for effectively preventing contamination of the regulator module assembly by a pressure gauge connected to the assembly and arising from removal and replacement of the pressure gauge.

2. The assembly of claim 1, wherein the contamination prevention means is disposed in the regulator module assembly such that the contamination prevention means cannot be damaged by the pressure gauge and cannot be dislodged and lost when the pressure gauge is removed and replaced.

3. The assembly of claim 1, wherein the contamination prevention means includes an insert means, defines a gas flow path through the regulator module assembly from the source, the gas flow path also communicating with the pressure gauge..

4. The assembly of claim 3, wherein the insert means acts as a diametrical seal interface for the gas cylinder and is threaded into a main body portion of the regulator module assembly.

5. The assembly of claim 3, wherein a filter is disposed in the insert means in the gas flow path that provides fluid communication through the source regulator module assembly.

6. The assembly of claim 5, wherein the filter is made of one of sintered bronze and stainless steel.

7. The assembly of claim 3, wherein the insert means is constructed and arranged to provide a circuitous flow path between the pressure gauge and the gas flow path from the source through the regulator module assembly, thereby preventing contamination from the pressure gauge entering that gas flow path.

8. The assembly of claim 3, wherein the insert means comprises one of one and two parts.

9. The assembly of claim 3, wherein the insert means is constructed of metal.

10. A regulator module assembly comprising a regulator module housing (12) and an insert means (14) fabricated as a unitary metal insert threadedly received at (16) in regulator module housing (12), the regulator module housing including a yoke portion (18) sized and shaped to accommodate an upright post valve (20) of a conventional high pressure gas cylinder (22), actuation and deactuation of the post valve (20) being achieved via a rotatable handle (24) that is threadedly received at (26) in yoke portion (18), regulator module assembly (10) further including means (28) for receiving a pressure gauge (30) releasably connected to the regulator module housing (12), the insert means (14) defining a gas flow path (32) between the high pressure gas cylinder (22) and the regulator module housing (12) and acting as a diametrical seal interface for the gas cylinder (22).

11. The assembly of claim 10 comprising a filter (34) disposed in the insert means (14) in the gas flow path (32) to prevent contamination that might occur at the connection of regulator module housing (12) and cylinder (22).

12. The assembly of claim 11, wherein the pressure gauge (30) communicates with the gas flow path (32) via a passageway (36) and the insert means (14) is constructed and arranged to provide a circuitous flow path between the pressure gauge (30), passageway (36) and gas flow path (32), thereby minimizing the likelihood that contamination from the pressure gauge might enter gas flow path (32).

13. The assembly of claim 12, wherein the insert means is disposed internally of the regulator module housing (12) in such a way that it cannot become displaced or lost when the pressure gauge (30) is removed and replaced.

14. A method of preventing contamination of a regulator module assembly, for delivering high pressure respiratory gas from a source to a

recipient, by a pressure gauge connected to the assembly and from removal and replacement of that pressure gauge from the assembly, comprising the steps of:

a) providing an insert means providing a gas flow path from the source through the assembly;

b) providing a circuitous path by means of the insert means, the circuitous path connecting the pressure gauge, when installed in the assembly, with the gas flow path, thereby preventing said contamination.

15. The method of claim 14, comprising the additional step of providing a filter disposed in the gas flow path of the insert means.

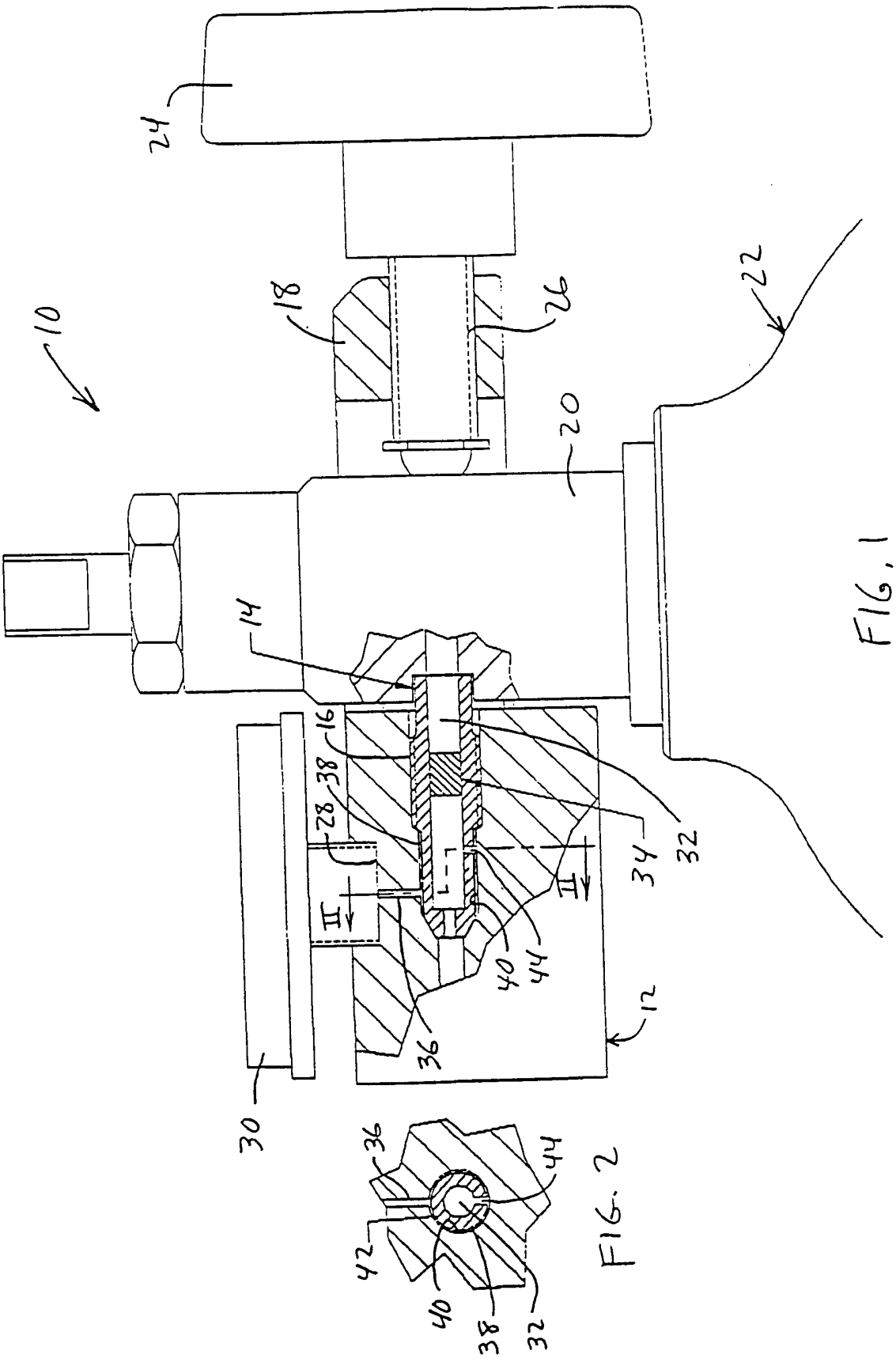


FIG. 1

FIG. 2

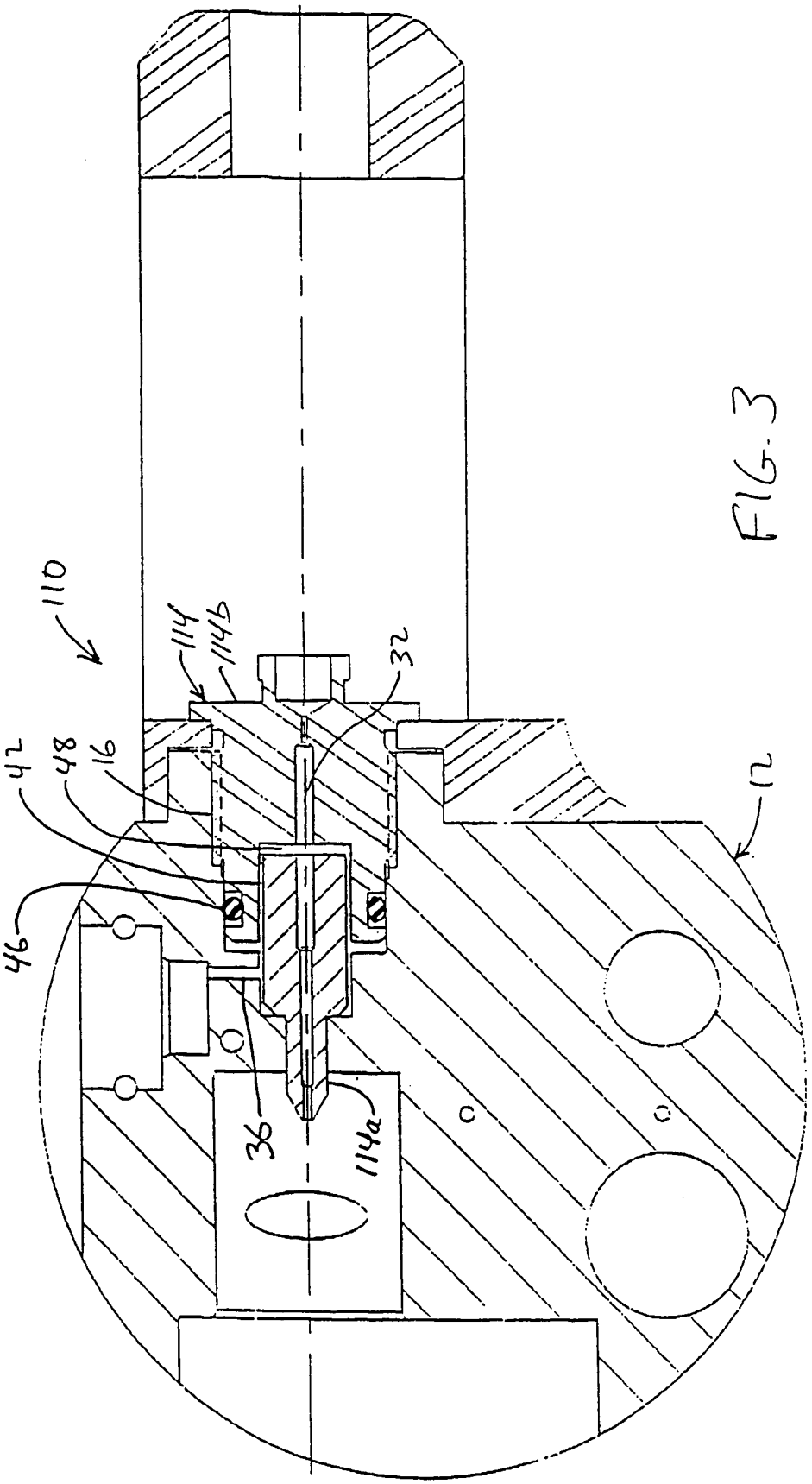


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/41064

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : A61M 16/00; A62B 9/02, 18/10, 19/00; B63C 11/02

US CL : 128/205.24, 205.12, 204.18, 204.26, 201.25, 201.27

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 128/205.24, 205.12, 204.18, 204.26, 201.25, 201.27

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,348,001 A (DANON) 20 September 1994, Figures 1-3, #6, 12, and 76; and cols. 3 and 4.	1-15
Y	US 5,379,761 A (SCHULER) 10 January 1995, Figures 1, 2, 5, and 6, #24 and 302.	1-15
Y	US 5,509,407 A (SCHULER) 23 April 1996, Figures 1 and 5, and #84.	5

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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