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Burkhartsmeier

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[54] **MULTIPLE CHROMATOGRAPHIC COLUMN SYSTEM**

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[52] **U.S. Cl.** ..... **210/198 C;** 55/386

[51] **Int. Cl.²** **B01D 15/08**

[58] **Field of Search** ..... 210/31 C, 198 C; 55/67, 55/197, 386

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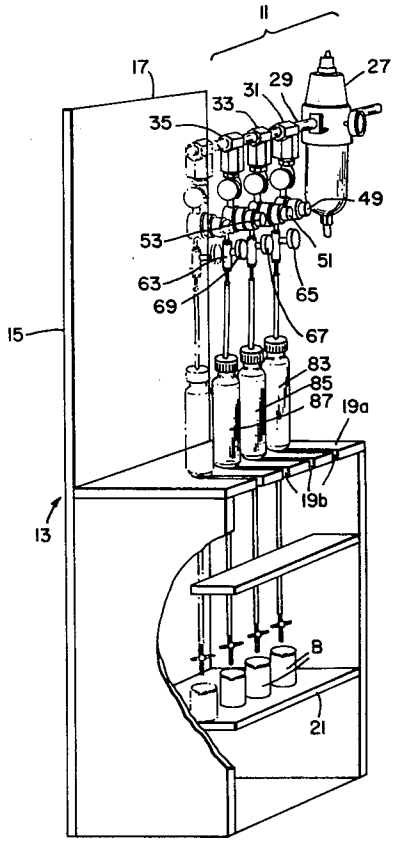
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[57] **ABSTRACT**

A multiple chromatographic column system comprising a multiple station column cabinet and a multiple outlet two stage pressure manifold. The system provides a reliable device which will perform pressurized multiple column chromatography.

1 Claim, 3 Drawing Figures



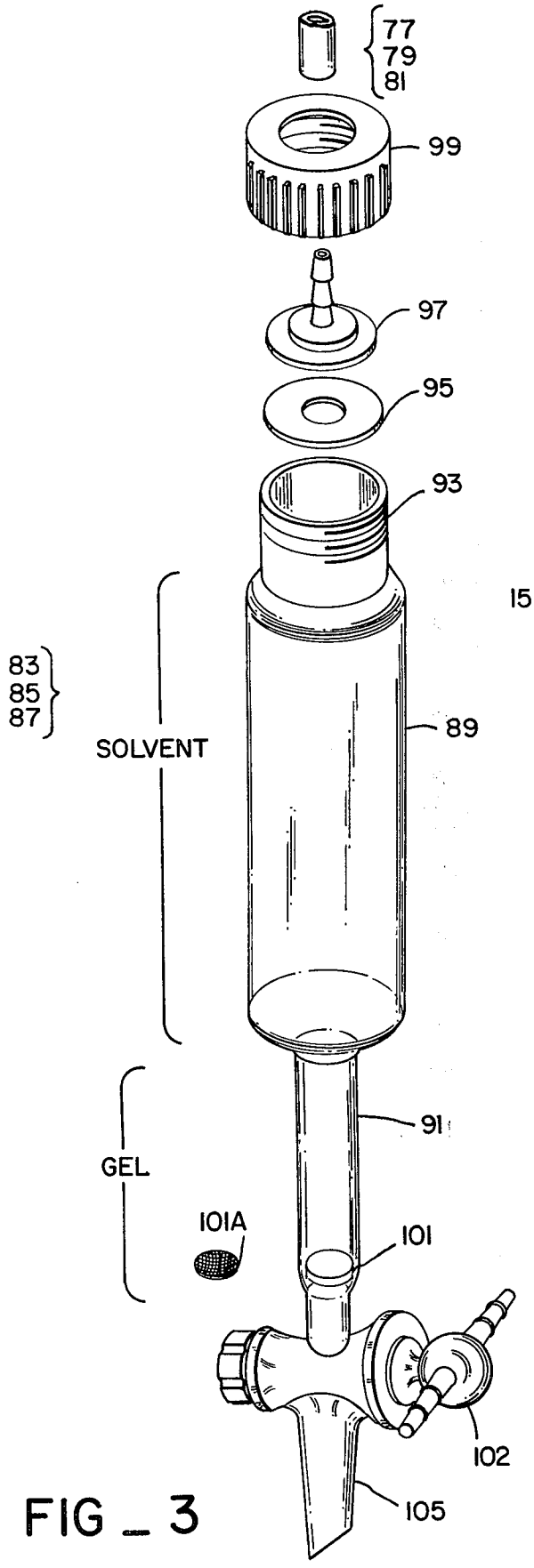

77
79
81
99
97
95
93
83
85
87
SOLVENT
89
91
GEL
101A
101
102
105

FIG _ 3

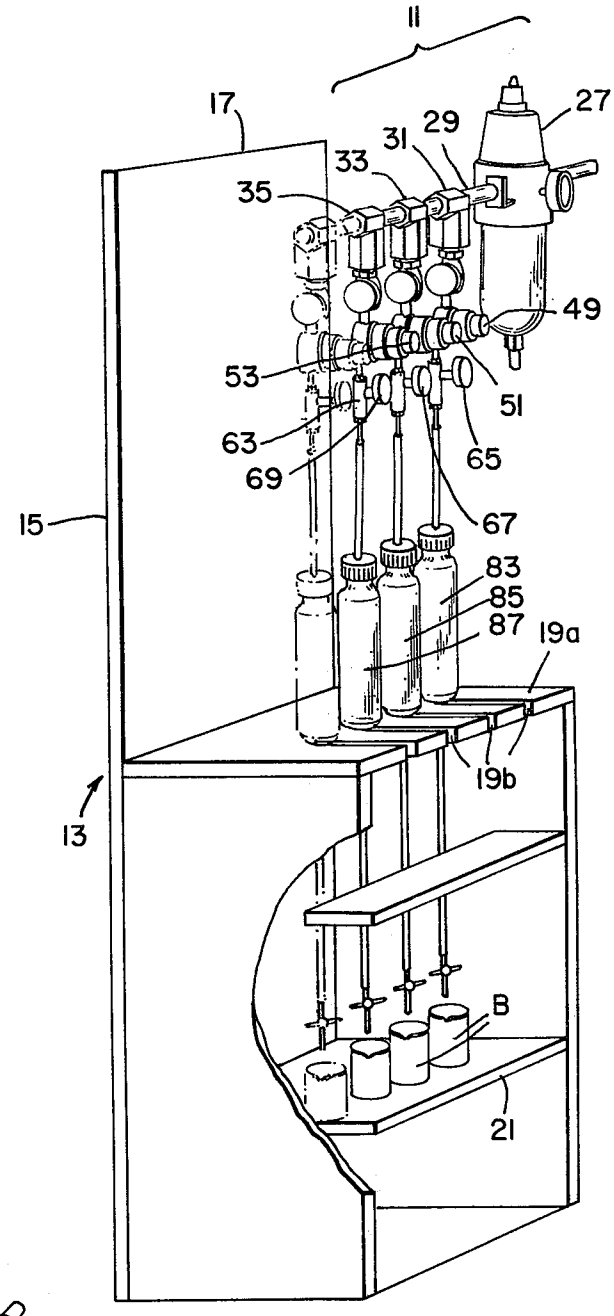

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33
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15
83
85
87
19a
19b
13
B
21

FIG _ 1

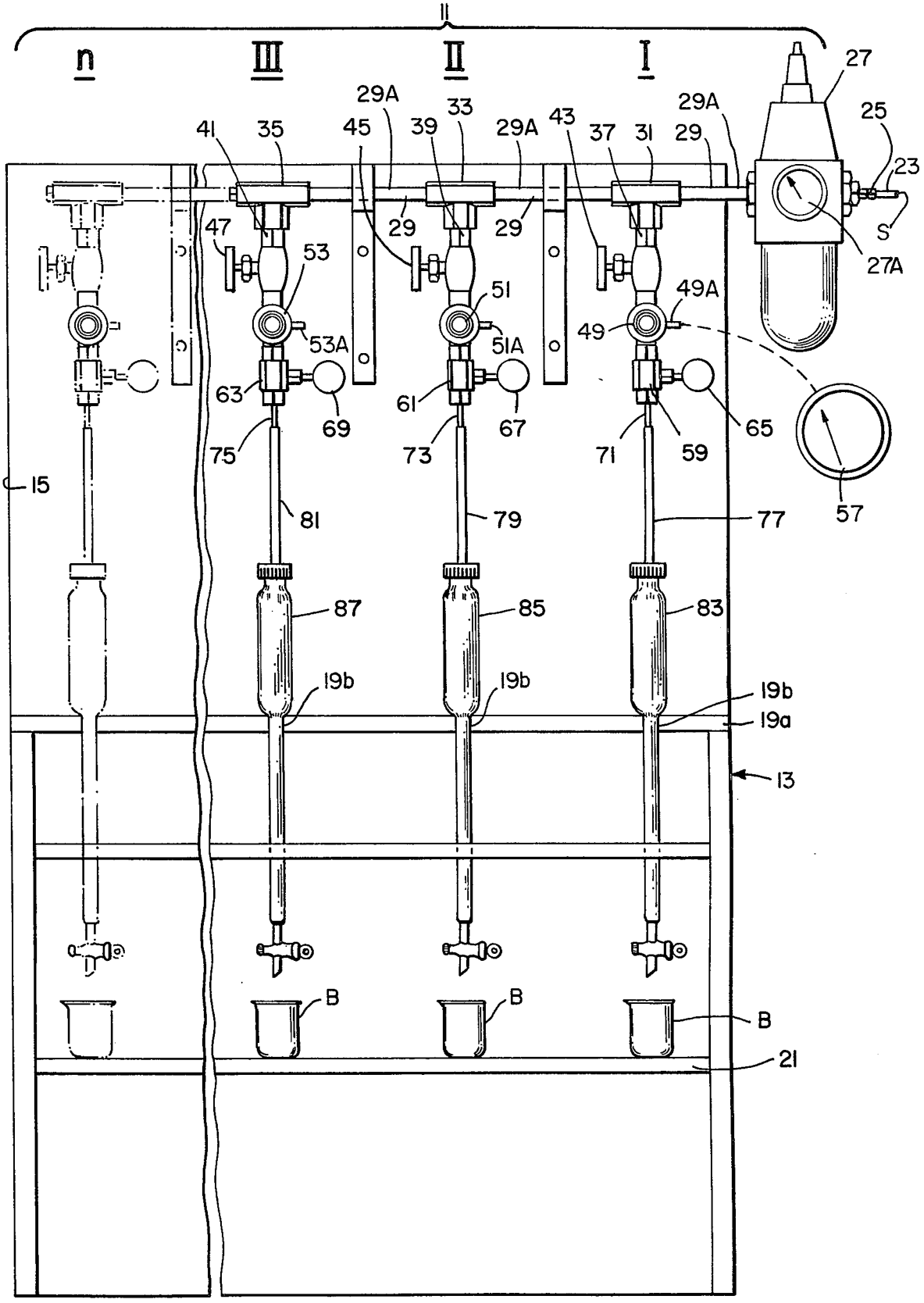

II
n
III
II
I
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25
23
S
27A
29A
41
35
45
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29A
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37
31
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29A
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53
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49A
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49
53A
51A
63
61
65
69
67
75
73
71
59
57
15
81
79
77
87
85
83
19b
19b
19b
19a
13
B
B
B
21

FIG_2

MULTIPLE CHROMATOGRAPHIC COLUMN SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The subject matter of the present invention is generally related to a device for performing pressurized column chromatography and more particularly a multiple chromatographic column system which will provide reliable pressurized multiple column chromatography.

2. Description of the Prior Art

Pressure chromatography is presently carried out by securing the column, usually on a burette stand, and applying pressure to the column by subjecting it to air from a laboratory flowmeter and discontinuing the flow of air when sufficient pressure has been achieved to yield adequate solvent flow through the column. Therefore, the actual pressure inside the column is never constant, thus the chromatographic parameters are continually changing and the reliability of the chromatograph is severely impaired. When too much pressure is applied to porous bead columns such as Sephadex LH-20 which are extensively used in steroid radioimmunoassays, the column packing tends to lose its homogeniety and often cracks, rendering the column unusable. In addition, much operator time and energy is wasted on observing and maintaining adequate solvent flow. Only one column per flowmeter can be operated and the apparatus for securing the column is bulky and inconvenient. The collection of column effluents often requires manipulation of the column itself and is difficult.

SUMMARY OF THE INVENTION

Briefly, the present invention is a multiple chromatographic column system comprising a multiple station column cabinet and a multiple outlet two stage pressure manifold. The system provides a reliable device which will perform pressurized multiple column chromatography.

STATEMENT OF THE OBJECTS OF THE INVENTION

A primary object of the present invention is to provide a multiple chromatographic system which will provide a reliable method of performing pressurized column chromatography on a mass production basis.

Another object of the present invention is to provide a device which precisely provides constant chromatographic parameters thus making chromatographic procedures more convenient, efficient and reliable.

Another object of the present invention is to provide a multiple chromatographic system which increases the productivity of a chromatographic system operation.

Other objects, advantages and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an isometric illustration of the multiple chromatographic column system and particularly showing the multiple station column cabinet and the multiple outlet pressure manifold.

FIG. **2** is a plan view of the multiple chromatographic column system, parts being broken away for purposes of illustration.

FIG. **3** is an isometric illustration of the pressure column of the multiple chromatographic column system illustrated in FIGS. **1** and **2.**

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. **1** and **2,** the multiple chromatographic column system is generally comprised of multiple outlet pressure manifold system **11** and multiple station column cabinet **13.** The present column system illustrated in FIGS. **1** and **2** is limited to three chromatographic columns I–III; however, it is obvious that the number (*n*) of outlets could be unlimited.

Cabinet **13** is comprised of vertical support **15,** manifold mounting brackets **17,** shelf **19***a*, keyway **19***b*, and lower shelf **21.** Shelf **19***a* functions as a positioning support guide for the pressure columns I–III and/or *n*. Lower shelf **21** is preferably made adjustable to allow clearance for various beaker configurations and effluent collection tubes. Pressure manifold system **11** may be secured to mounting brackets **17** by any number of well known mounting methods.

Referring to FIGS. **1** and **2** and particularly to FIG. **2,** pressure manifold system **11** is connected to an air pressure source S via air line **23** which is connected to adapter **25.** Adapter **25** is coupled to filter regulator **27.** Filter regulator **27** may include, if desired, a line pressure gauge **27A** to measure the line air pressure from source S. Filter regulator **27** is a standard filter regulator and provides effective filtration as well as controlled pressure. a BO2 Norgren Filter-Regulator or the like may be used. Filter regulator **27** is operatively coupled to manifold line **29.** Manifold line **29** is formed by interposing conduit pipes **29A** between standard pipe tees **31, 33,** and **35.** The distal end of the last tee should be plugged. On/off needle valves **43, 45** and **47** are respectively connected to tees **31, 33** and **35** via reducers **37, 39** and **41.** Reducers **37, 39** and **41** are preferably from about one-fourth inch to about one-half inch for proper air pressure maintenance; however, these measurements may vary depending on the specific operative limits desired. On/off needle valves **43, 45** and **47** provide the proper flow/no flow conditions to the individual columns I–*n*. Moreover, needle valves **43, 45** and **47** provide for independent as well as simultaneous operation of the individual columns I–*n*. Secondary regulators **49, 51,** and **53** are operatively coupled to needle valves **43, 45,** and **47** respectively. Secondary regulators **49, 51,** and **53** can be a Type RO6 Norgren device which is a standard pressure relief secondary regulation device. Adapters **49A, 51A** and **53A** may be included in the system to measure column air pressure. A pressure gauge **57** such as a magnehelic gauge may be individually operatively coupled to each adapter to test the individual system column pressure for columns I–*n* if desired. Secondary regulators **49, 51,** and **53** are operatively coupled to standard needle bleed valves **65, 67,** and **69** via pipe tees **59, 61,** and **63** respectively. Needle bleed valves **65, 67,** and **69** allow for bleeding off the system pressure in the individual columns I–*n* if desired. The needle valves also allow the operator to bleed the internal pressure of each column I–*n* when the manifold needle valves are in the off position.

Referring again to FIG. **2,** pressure tubings **77, 79** and **81** are connected to the distal ends of tees **59, 61,**

and **63** via hose connectors **71, 73** and **75.** These pressure tubings **77, 79** and **81** are connected to pressure columns **83, 85** and **87** which will be described below. Since columns **83, 85** and **87** are structually and functionally similar, then a description of one column will be deemed to apply to all of the columns I–*n*.

Referring to FIG. **3** pressure column (**83, 85,** and **87**) is generally comprised of reservoir **89,** column stem **91,** threaded sector **93,** seal **95,** hollow adapter **97,** filler cap **99,** stop cock **102** and spout **105.** Pressure column(s) (**83, 85, 87**) provides a reservoir for both the mobile phase gas liquid or solid as well as the stationary phase, gas, liquid or solid.

For purposes of illustration a mobile phase solvent and a stationary phase gel is used; however, the function of the unique multiple chromatographic column system would not be limited to the use of these particular constituents. Adapter **97** fits into the aperture located in filler cap **99.** Seal **95,** also having an aperture, is placed between hollow threaded section **93** and aligned with the base of adapter **97.** Seal **95** and adapter **97** are held in place by filler cap **99.** The protruding portion of adapter **97** is inserted into one of the open ends of tubing (**77, 79, 81**). This allows the manifold system **11** air pressure to contact the mobile phase solvent. The cross-sectional distal end of column stem **91** contains a securely mounted sintered glass disc **101.** Sintered disc **101** to retain all stationary phase solids in this case gel, while allowing the mobile phase solvent to infiltrate the disc **101.** Any standard sintered glass material will suffice for this specific type of filtration process.

A teflon mesh disc **101A** may be superimposed over the surface area of disc **101** to prevent destruction of porous chromatographic beads which may be used in ion exchange and gel permeation chromatographic processes.

To initiate operation of one of the columns the operator will initiate the main air supply, adjust the manifold pressure system by setting the main filter-regulator **27** to about 10–15 p.s.i., open one of the needle valves from manifold line **29** to the individual regulators. Finally, set the individual air regulators until the desired solvent flow is achieved.

To discontinue solvent flow close needle valve of the individual regulator(s) and momentarily crack the corresponding bleed valve to release the internal column pressure.

The system supplies an adjustable and a constant pressure to drive chromatographic columns. This system provides constant chromatographic parameters thus making chromatographic procedures more convenient, more efficient, and more reliable. In addition, this device makes it possible for one operator to simultaneously operate any number of chromatographic columns utilizing only one laboratory air outlet. This system greatly increases an operator's productivity and provides a cost effective procedure. The danger to the column packing due to overpressurization is now eliminated.

Miniaturization of system **11** may be possible. The two-stage pressure manifold may be constructed of something other than brass fittings (i.e., nylon tubing and POLY-FLO connectors for cost reduction). Alternative construction materials for the cabinet necessitate that it provide unobstructed view of the column packing and must be impervious to organic solvents. The system functions to force the mobile phase material into stationary material under controlled pressure as well as volume.

What is claimed is:

1. A chromatographic column system for forcing a mobile phase material through a stationary phase material comprising:

a. an air source;

b. said air source connected to the input of a primary regulator;

c. the output of said regulator connected to the input of a manifold;

d. the output of said manifold connected to the input of at least one on/off needle valve;

e. the output of said at least one on/off needle valve connected to at least one secondary regulator;

f. the output of said at least one secondary regulator connected both to at least one needle bleed valve and to at least one pressure column;

g. the output of said at least one pressure column connected to at least one filter;

h. the pressure in said at least one pressure column is maintained on or about a constant value; and

i. said at least one on/off needle valve, said at least one secondary regulator, said at least one needle bleed valve, said at least one pressure column, and said at least one filter respectively comprise a plurality of on/off needle valves, a plurality of secondary regulators, a plurality of needle bleed valves, a plurality of pressure columns and a plurality of filters.

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