United States Patent [19]

Turney

[11] **3,834,372**

[45] **Sept. 10, 1974**

[54] **DISPOSABLE MANIFOLD WITH ATMOSPHERIC VENT**

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[22] Filed: **Jan. 12, 1973**

[21] Appl. No.: **323,272**

[52] **U.S. Cl.** ..... **128/2 F,** 137/625.47, 128/274, 251/310

[51] **Int. Cl.** **A61b 5/02,** A61m 1/00

[58] **Field of Search** ..... 128/2.05 D, 2.05 E, 2 F, 128/2.05 R, 214 R, 221, 274; 137/625.41, 625.42, 625.47, 625.24, 625.16, 625.15, 625.19; 251/181, 309, 310, 184, 297; 73/388 R, 398, 392.4, 389

[56] **References Cited**

UNITED STATES PATENTS

717,899	1/1903	McDonald	137/625.47 X
1,854,307	4/1932	Hapgood	137/625.19
2,409,435	10/1946	Ketay et al.	73/388 R
2,485,842	10/1949	Pennington	128/214 R
2,600,324	6/1952	Rappaport	73/388 R
2,960,086	11/1960	Keller	137/625.47 X
3,157,201	11/1964	Littmann	128/2.05 D
3,526,136	9/1970	Caldwell, Sr. et al.	251/309 X
3,526,218	9/1970	Reiss	128/2.05 D
3,610,228	10/1971	Temkin	128/2.05 D

FOREIGN PATENTS OR APPLICATIONS

560,788	4/1957	Italy	137/625.47
1,116,997	6/1968	Great Britain	128/2.05 D

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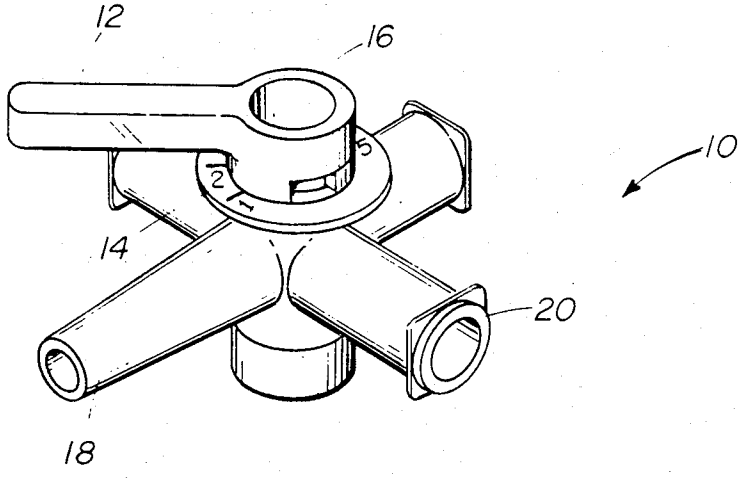
Assistant Examiner—J. C. McGowan
Attorney, Agent, or Firm—Walter G. Finch, Esq.

[57] **ABSTRACT**

A manifold is formed with a plurality of ports for connection to various components such as arterial-venous pressure generators, a syringe, and a source of fluid and pressure sensitive transducers. The manifold includes one or more rotary members which are selectively positioned for interconnecting selected ones of the components. Various sampling, flushing and pressure measuring operations may be performed by use of the manifold. The manifold further includes a venting port arrangement for venting the pressure sensitive transducers to the atmosphere when a pressure measurement is not being taken. This protects the transducer from overpressurization and consequential damage.

14 Claims, 10 Drawing Figures



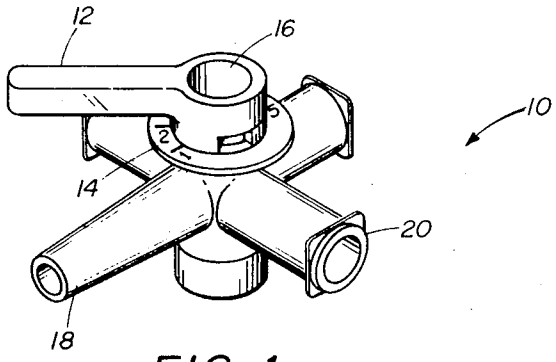

12
16
10
14
20
18

FIG. 1

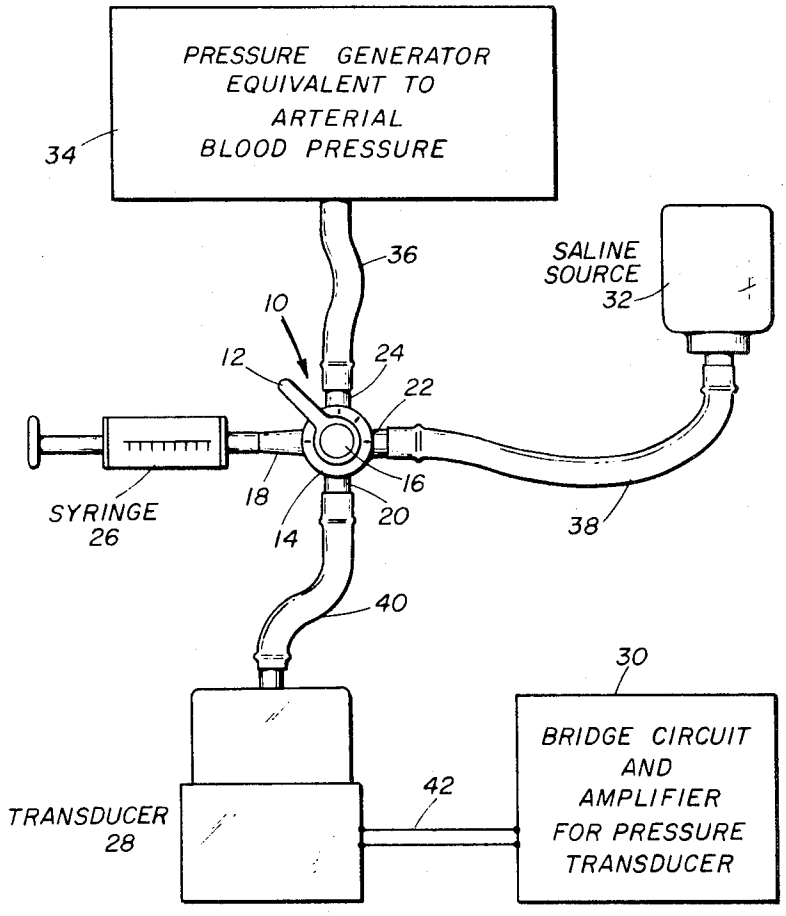

PRESSURE GENERATOR EQUIVALENT TO ARTERIAL BLOOD PRESSURE
34
36
SALINE SOURCE
32
10
12
24
22
SYRINGE
26
18
16
14
20
38
40
30
BRIDGE CIRCUIT AND AMPLIFIER FOR PRESSURE TRANSDUCER
42
TRANSDUCER
28

FIG. 2

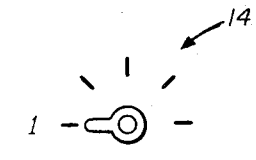
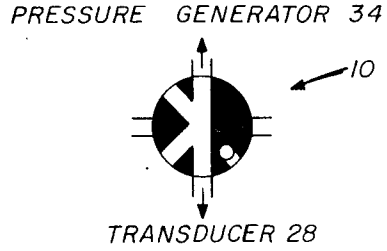
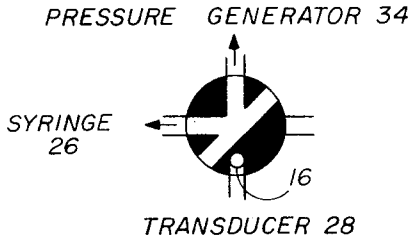
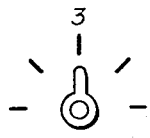
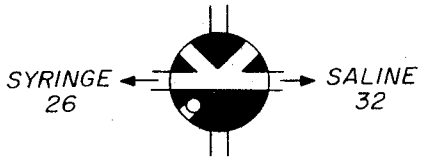
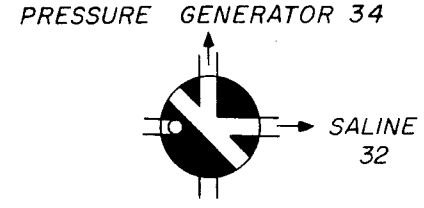
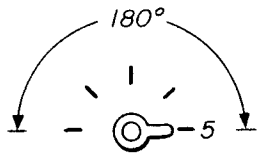
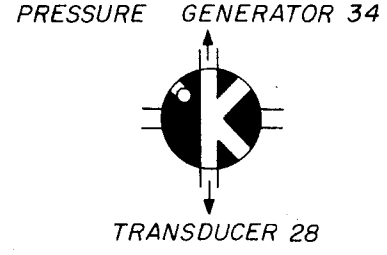
HANDLE POSITION	HYDRAULIC CIRCUIT	FUNCTION
		MEASURE
		WITHDRAW FLUSH BALANCE
		FILL
		FAST FLUSH WITHOUT SYRINGE
		MEASURE

FIG. 3

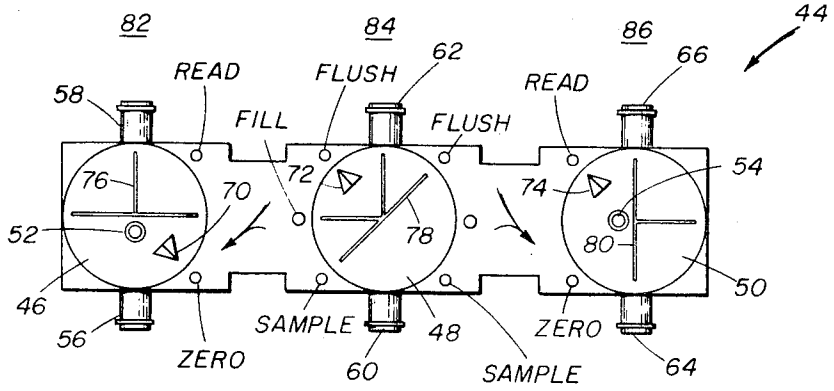


FIG. 4

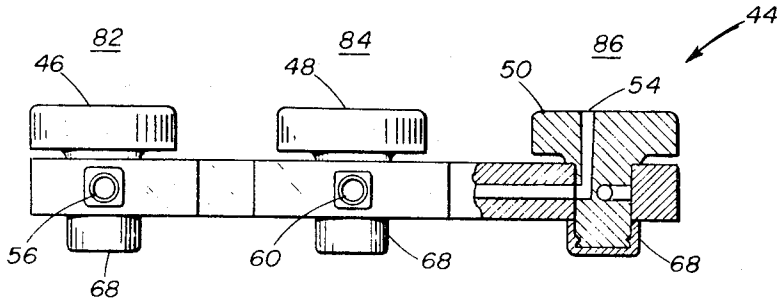


FIG. 5

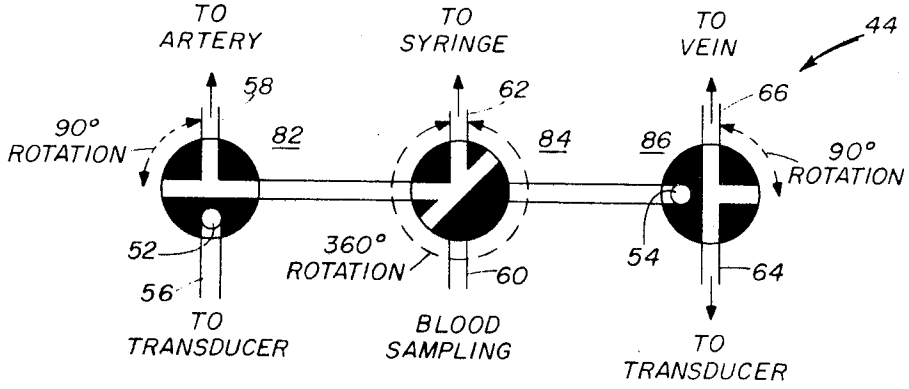


FIG. 6

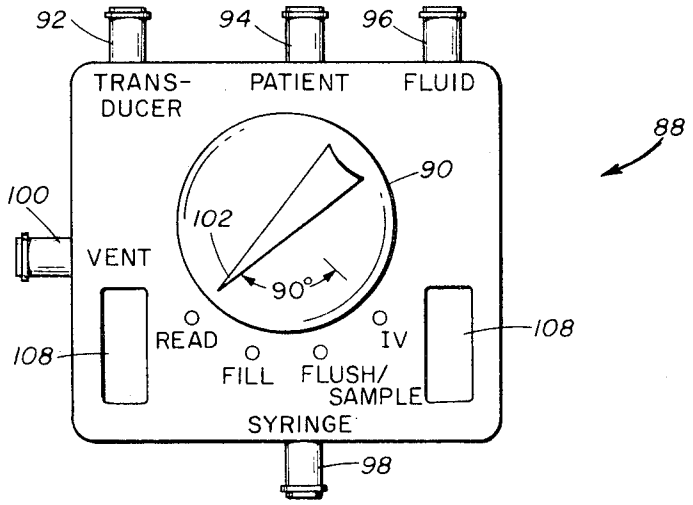


FIG. 7

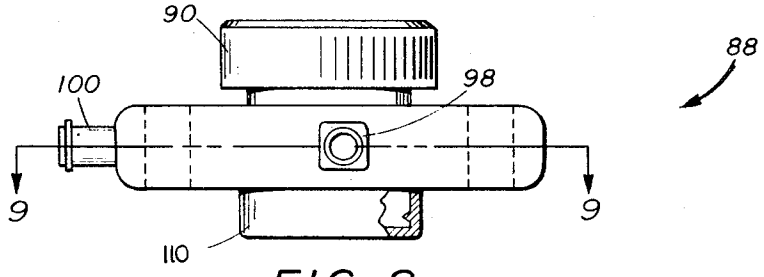


FIG. 8

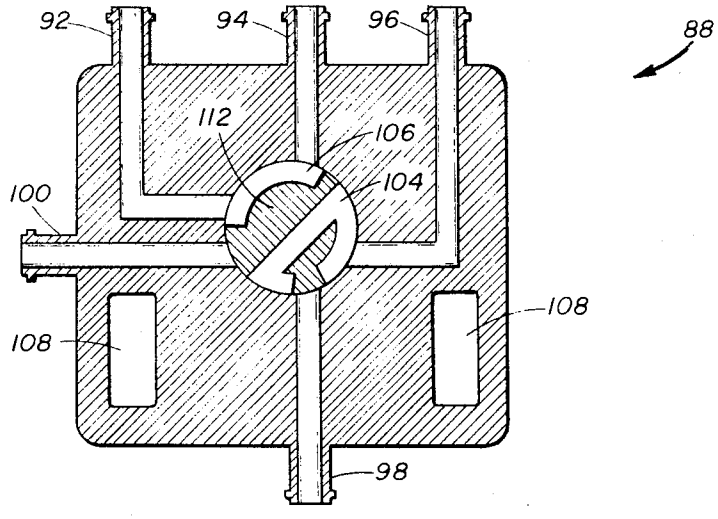


FIG. 9

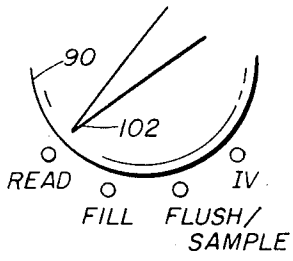
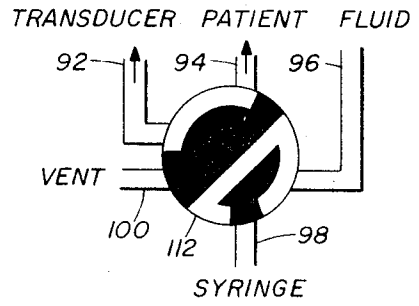
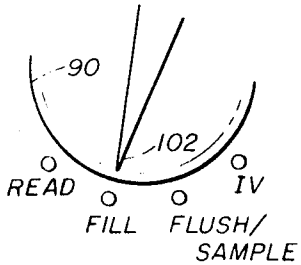
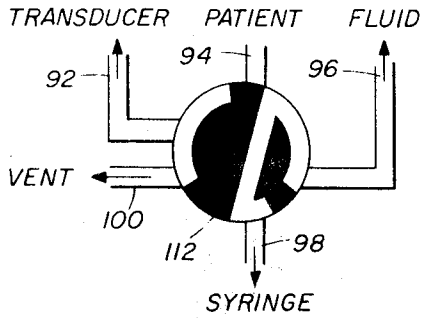
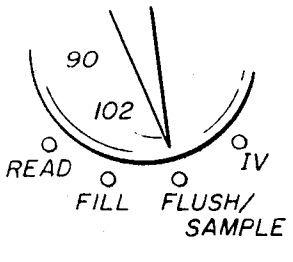
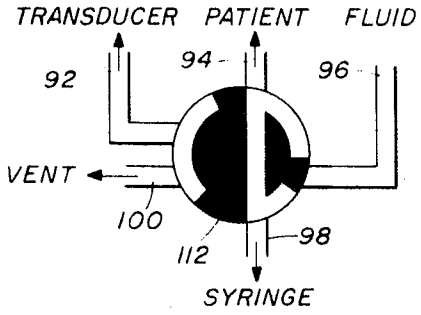
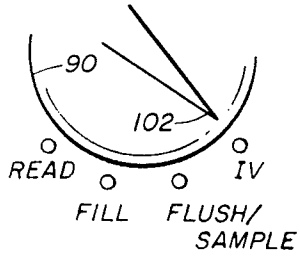
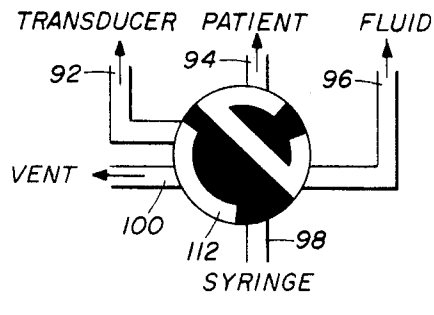
SWITCH POSITION	HYDRAULIC CIRCUIT	FUNCTION
		READ TRANSDUCER ↕ PATIENT
		FILL SYRINGE ↕ FLUID TRANSDUCER ↕ VENT
		FLUSH/SAMPLE SYRINGE ↕ PATIENT TRANSDUCER ↕ VENT
		IV FLUID ↕ PATIENT TRANSDUCER ↕ VENT

FIG. 10

DISPOSABLE MANIFOLD WITH ATMOSPHERIC VENT

This invention relates to protective manifolds, and more particularly to a manifold used with pressure sensitive transducers in the measurement of a system under pressure and with related sampling and flushing components.

There is a constant need for the measurement of pressure existing within a system such as, for example, an arterial blood system of a human being. This can be accomplished by connecting the pressure system to a pressure sensitive transducer which develops a readable measurement. In blood pressure measuring systems using this principle, a manifold is frequently employed to permit the further sampling of blood through the pressure line connected to the artery of the patient and, further, to permit flushing of the pressure line to insure removal of coagulated blood and other undesirable substances.

In use of available manifolds for this multiple purpose, the transducers are subjected to continuous pressurization during the sampling and flushing operations. This could be caused by an external flushing source which is constantly flushing a fluid through the transducer as a necessity for operation of the transducer. Or it could also be caused by having the sampling or flushing lines turned into the transducer during periods when sampling or flushing operations are in progress.

Regardless of the reason or manner in which the transducer is continuously pressurized, overpressurization frequently occurs in the transducer which is seriously damaged as a result thereof. Needless to say the time and cost of repairing the damaged transducer results in an expensive maintenance program and requires additional inventory to insure the availability of working transducers when needed. In many instances such damaged transducers are irrepairable.

Thus, there is a need for a manifold which will permit selective pressure measurement and further sampling and flushing operations of a fluid-pressure system, such as the arterial blood system of a human being, without overpressurizing the transducer at anytime during the various operations.

The manifold usually includes some form of valving arrangement to permit the conditioning of the manifold for the various sampling, flushing and measurement operations. It is critically important, especially in medical applications of the manifold, that some means be used to provide external indication of the particular positioning of the valve arrangement. This will insure safety in the various operations.

Additionally, some means should be provided for insuring that the various components be connected to proper ports of the manifold. Otherwise improper connections between components can result with potentially serious consequences.

As noted previously, in one medical application of such a system, blood can be drawn from the patient in the sampling operation by use of the pressure line and certain portions of the manifold. Generally, this results in the collection of coagulated blood in the pressure line and manifold and causes a reduction in pressure during subsequent pressure-measuring operations.

In order to overcome this deficiency, there is a need for a flushing system which permits selective flushing of the portions to be cleaned without subjecting the pressure sensitive transducer to any pressurized fluids during the flushing period.

It is an object of this invention, therefore, to provide a manifold which will permit selective utilization of a pressure sensitive transducer and sampling and flushing facilities without overpressurization of the transducer.

Another object of this invention is to provide a manifold which is sufficiently labeled to permit selective utilization thereof in sampling, flushing and pressure measuring operations.

Still another object of this invention is to provide a manifold which is labeled to insure the connecting of the external facilities to selected ports for proper and desired sampling, flushing and pressuremeasuring operations.

A further object of this invention is to provide a manifold which will properly vent a pressure sensitive transducer during sampling and flushing operations being conducted through the manifold exclusive of the transducer.

Other objects and attendant advantages of this invention will become more readily apparent and understood from the following detailed specification and accompanying drawings in which:

FIG. **1** is a perspective view of a complete multiport manifold assembly embodying certain principles of the invention;

FIG. **2** is a block diagram showing the manifold of FIG. **1** assembled in a typical application;

FIG. **3** is a chart-schematic diagram showing five positions of a rotary valve member of the manifold of FIG. **1** and the function thereof at each position;

FIG. **4** is a plan view of three-valve, multiport manifold further embodying certain principles of the invention;

FIG. **5** is a side view of the manifold of FIG. **4** with a section cut away to show an overflow vent arrangement;

FIG. **6** is a schematic diagram showing the three-valve manifold of FIGS. **4** and **5** and the various selectively available positions for the valves;

FIG. **7** is a plan view of a sophisticated, singlevalve, multiport manifold embodying still further principles of the invention;

FIG. **8** is a side view of the manifold of FIG. **7**;

FIG. **9** is a sectional view taken along line **9—9** of FIG. **8** showing details of the manifold of FIGS. **7** and **8**; and

FIG. **10** is a chart-schematic diagram showing four positions of a rotary valve member of the manifold of FIGS. **7, 8** and **9** and the function thereof at each position.

Referring to FIG. **1**, there is shown a protective manifold **10** composed of a plastic material and embodying certain principles of the invention. The manifold **10** includes a control handle **12** which controls the position of a rotary valve member formed integrally with the handle. A handle-position-indicator dial **14** is located adjacent to the handle **12** and cooperates with the handle, which also functions as a pointer, to identify a number of selectable handle positions. The rotary valve member is formed with an opening **16** at one end thereof which facilitates atmospheric venting of a selected port of the manifold **10**. Further, numbers on the dial **14** indicate functional positioning of the rotary

valve member. A plurality of stems are formed integrally with and extend radially from a central, hollow-hub housing having an opening which contains the rotary valve member. Two of the stems form a syringe port **18** and a transducer port **20.**

As further illustrated in FIG. **2,** additional stems form a saline or flushing fluid port **22** and a pressure port **24.** The manifold **10** is arranged and connected so that a syringe **26** is connected to the syringe port **18.** A pressure-responsive transducer **28** is connected to the port **20.** The transducer **28** controls a bridge circuit and amplifier **30** to provide a readable measurement of pressure being analyzed. A saline source **32** which may be used for a flushing fluid, is connected to the port **22** and a pressure generator **34** is connected to the port **24.** Feed lines **36, 38** and **40** are used to facilitate the above-mentioned connections. Conductors **42** are used to connect the transducer **28** to the bridge circuit and amplifier **30.**

The illustrated syringe **26** is a typical type of hydraulic syringe. However, other types of facilities could be used. For example, a bag, capable of containing a fluid, could be connected to the port **18** and squeezed and manipulated by hand to provide the necessary pressure reaction which is commonly accomplished by the syringe **26.**

The transducer **28,** as illustrated, is a dome type which has a flushing fluid (not shown) being constantly flushed therethrough from an external source (not shown) to prevent damping of a pressure wave form being coupled to the transducer through the manifold **10.** However, other types of transducers could be utilized. Or direct-reading, pressure-responsive devices such as mercury-filled manometers can be used.

The pressure generator **34** is equivalent to arterial blood pressure of a patient. The feed line **36** could be connected to a catheter, or similar device, for direct insertion into various areas of a patient to measure arterial, venous, cerebral, spinal fluid, gastrointestinal tract and lung pressures.

In use, the handle **12** is manipulated to position the rotary valve member within the hub housing so that channels formed internally of the rotary valve member provide an open passageway between selected ports within the manifold **10.** This will permit, for example, connecting of the pressure generator **34** with the transducer **28.** The generator **34** can be connected to the syringe **26** for withdrawal of blood samples. The syringe **26** can be connected to the saline source **32** for the withdrawal of flushing fluid into the syringe for subsequent injection of the fluid into the feed line **36** for cleaning coagulated blood therefrom. An intravenously injectable fluid can replace the saline source **32** and the rotary valve member then positioned to permit direct infusion of the fluid through the manifold **10** into the patient.

The stems of the ports **18, 20, 22** and **24** can be of different structure or geometry to indicate which ports are to be connected to the various components such as the syringe **26,** transducer **28,** saline source **32** and generator **34,** respectively. Further, the stems could be color coded for the same purpose.

Referring to FIG. **3,** the chart-schematic diagram is divided into three columns and five rows. The first column illustrates the position of the handle **12,** and consequently the position of the rotary valve member.

The second column shows the hydraulic circuit of the manifold **10,** including the position of the rotary valve member and its internal passageway alignment. The third column shows the function of the manifold **10** in the various positions of the rotary valve member.

When the handle is in position **1,** the passageway of the rotary valve member of the manifold **10** connects the pressure generator **34** to the transducer **28** with the resultant function being to measure the pressure. Notice that all remaining ports are closed by virtue of the selective positioning of the rotary valve member.

In position **2** of the handle, the pressure generator **34** is connected to the syringe **26.** This permits the withdrawal of fluid, such as blood, from the patient by withdrawing the plunger of the syringe **26.** This provides patient specimens for analyzation. It should be noted that blood will probably coagulate in the line **36** and passageway of the rotary valve member. This could cause a loss of pressure in later pressure-measuring operations.

After the syringe **26** containing the sampling of blood is removed, another syringe can be connected to the port **18** and the handle **12** moved to position **3.** This connects the syringe **26** with the saline source **32** whereafter the saline solution can be withdrawn into the syringe to perform the function of filling the syringe with flushing fluid. The handle **12** is moved to position **2** where manipulation of the syringe plunger injects the flushing fluid through and cleans the passageway of the rotary member and thereby removes the coagulated blood.

It is particularly significant to note that while the handle **12** is in position **2,** the transducer **28** is vented through the manifold **10** by the vent port **16** formed centrally in one end of the rotary valve member. This venting, when flushing or sampling withdrawal operations are occurring, protects the transducer **28** from overpressurization and consequential damage. The pressure in the transducer **28** is developed by the high pressure flushing of a fluid through the dome of the transducer for the previously mentioned damping purpose. The venting of the transducer **28** precludes the build-up of pressure beyond an acceptable threshold within the transducer and thereby prevents damage and irrepairable destruction of the transducer.

When the handle is placed in position **4,** the passageway of the rotary valve member connects the pressure generator **34** and the saline source **32** for direct fast flushing of the passageway and feed line **36.** Additionally, the saline source **32** could be replaced by a fluid which is to be fed directly into the patient.

The handle **12** can be placed in position **5,** for a full 180° position swing, to accomplish the same function as is accomplished in position **1.**

In another embodiment of the invention, a three-valve, multiport, plastic manifold **44** is illustrated in FIG. **4.** The manifold **44** includes three knobs **46, 48** and **50** which are integrally formed with rotary valve members as illustrated by knob **50** and its related valve member in FIG. **5.** The knobs **46** and **50** are formed with vent ports **52** and **54,** respectively. A series of stems extend laterally from opposite sides of a longitudinal housing of the manifold **44** and form ports **56, 58, 60, 62, 64** and **66.**

The longitudinal housing of the manifold **44** is formed internally with passageways which extend between and communicate with openings formed in the

housing. The openings receive and contain the rotary valve members which are also formed internally with passageways which are alignable with the passageways of the longitudinal housing. Locking caps **68** (FIG. **5**) are positioned over and locked on the exposed bottom portions of the rotary valve members to secure for rotation the knobs **46, 48** and **50** and related rotary valve members with the longitudinal housing.

As further illustrated in FIG. **4**, the knobs **46, 48** and **50** are formed on the face thereof with position indicators or pointers **70, 72** and **74**, respectively, and passageway indicators **76, 78** and **80**, respectively. The three valve assemblies which include the knobs **46, 48** and **50** are designated **82, 84** and **86** respectively.

The knob-visible face of the longitudinal housing are provided with label points about the periphery of the knobs **46, 48** and **50** which can be read in cooperation with the position indicators **70, 72** and **74** to indicate the functional positions of the particular valve assemblies **82, 84** and **86.** To further facilitate the determination of functional positioning of the valve assemblies **82, 84** and **86,** each label point has a literal label placed adjacent thereto such as "READ", "FLUSH", "FILL", "SAMPLE" or "ZERO." Although these labels would appear in the face of the longitudinal housing, they are illustrated away from the face for clarity purposes only.

The longitudinal housing is formed with spaced notches on opposite sides of longitudinal edges thereof to facilitate the secure mounting of the manifold **44** to an attaching structure. This keeps the assemblies **82, 84** and **86** from being vibrated, or from altering their positions due to vibrations, with reference pressure being measured.

As illustrated in FIG. **6**, the use of the manifold **44** permits the assembly of two transducers and two pressure generating systems (artery and vein) thereto. Also the assemblies **82** and **86** have a 90° rotation limit while the assembly **84** is rotatable through a full 360°.

As shown, the assemblies **82** and **84** are positioned to connect an artery line to a syringe for flushing purposes while the assembly **86** is positioned to permit the measurement of venous pressure through a transducer. It is noted that the transducer which is connected to the port **56** is vented through the vent port **52** for protective precluding of overpressurization as previously explained while the flushing operation is in progress. By selective positioning of the valve assemblies **82, 84** and **86,** various combinations of sampling, flushing and pressure measurement operations can be conducted. In any case, the transducers will always be vented when not being used for pressure measurement.

As illustrated in FIG. **7**, a single valve multiport, plastic manifold **88,** embodying certain principles of the invention, includes a knob **90** which is formed integrally with a rotary valve member **112** (FIG. **9**). The rotary valve member **112** is positioned within a central opening of a manifold housing. Three stems form ports **92, 94** and **96** and extend from a rear face of the manifold housing. The ports **92, 94** and **96** are to be connected to a transducer, a patient and a fluid source, respectively, as labeled on the top face of the housing. Another stem forms a port **98** and extends from a front face of the housing. The port **98** is to be connected to a syringe as labeled on the top face of the housing. Still another stem forms a port **100** and extends from a side face of the housing and is normally open to the atmosphere to serve as a vent as labeled on the top face of the housing.

The knob **90** is provided with a pointer **102** which cooperates with four labeled points on the top face of the housing to indicate whether the manifold **88** is in a "READ", "FILL", "FLUSH/SAMPLE" or "IV" mode.

As illustrated in FIG. **9**, each of the ports **92, 94, 96, 98** and **100** communicate with passageways formed internally of the housing which extend to the central opening. The internal passageways of the housing then selectively communicate with precisely formed passageways **104** and **106** in the rotary valve member **112.**

Referring to FIG. **7**, openings **108** are formed in the housing of the manifold **88** to facilitate securing of the manifold to an attaching structure which could be a fixed frame or the patient.

As shown in FIG. **8**, a locking cap **110** is secured over the lower exposed end of the rotary valve member **112** to secure for rotation the member to the housing.

It is also noted that the syringe port **98** extends from the front face of the manifold **88** and thereby permits ready access to the port for the only component, the syringe, which may be frequently worked, or exchanged, during performance of the various operations associated with other components attached to the manifold. The remaining ports **92, 94, 96** and **100** are located on the rear or side faces to avoid confusion and danger of introducing wrong substances into the patient.

Referring to FIG. **10**, the chart-schematic diagram is displayed in the same column and row arrangement as the diagram of FIG. **3.**

When the pointer **102** is on the "READ" position, the rotary valve member **112** is positioned so that the transducer and patient are connected so that the pressure being sensed can be read. As noted previously this could be other pressure areas of the body other than that associated with the blood.

With the pointer **102** on the "FILL" position, the syringe is connected to the fluid source to permit the withdrawal of fluid into the syringe for subsequent flushing operation. It is important to note that the transducer is vented during this "FILL" operation.

As the pointer **102** is placed on the "FLUSH/SAMPLE" position, the syringe and the patient are connected to permit a line and manifold flushing operation or a blood or other patient substance sampling operation. It is further noted that the transducer continues to be vented during the "FLUSH/SAMPLE" operation.

The pointer **102** can also be moved to the "IV" position, which stands for intravenous position, wherein the fluid source is connected to the patient. If the fluid is a flushing fluid, it can be fed directly and quickly to the manifold **88** and the associated patient line for flushing foreign substances such as coagulated blood. It could also be used to infuse continuously intravenously various solutions used in the treatment of patients. Again, the transducer is vented during the "IV" operation.

Thus the transducer is vented for protection against overpressurization during each operation in which the transducer is not being used when the manifold **88** is utilized.

Further, the vent port **100** can be used to fill the dome of the transducer with fluid for damping purposes, which has been previously mentioned. This can

be accomplished at any position except the "READ" position by connecting a syringe to the vent port **100** and injecting fluid from the syringe into the dome.

The stems of the manifolds **44** and **88** could also be formed of different structure or geometry, or be color coded, to identify the functional purpose thereof rather than have the labels on the face of the respective housings.

It is also possible to control the movement of the various rotary valve members of the various embodiments of manifolds **10, 44** and **88** by use of an external controlling device (not shown). For example, the rotary valve member can be physically connected to an electrical control system which automatically rotates the valve member in response to electrical signals. The electrical control system could be operated selectively by a program or by a sequential timing circuit. Further, the valve member could be a sliding member rather than rotary. Or it could be both sliding and rotary and thereby movable to different levels of port-connecting facilities to expand the capabilities of the manifold.

The valve member could be formed of a structure which is controlled by an external device (not shown) to alter the arrangement of the internal passageways by a variety of means such as by rotation or sliding movement. For example, the valve member could include a pair of elements rotatable relative to each other with a combined internal passageway configuration when two elements are in one relation and another configuration when the elements are rotated relative to each other to a second relation. The two elements of the valve member would be rotated together when used in the manifold for the functions previously described and rotated relative to each other when it is desired to change the particular passageway relation for use in additional functions with the manifold. The same principle could be accomplished if the pair of elements were slidable, rather than rotatable, relative to each other.

The manifolds **10, 44** and **88** are sufficiently small, lightweight and inexpensive so that they may be presterilized and packaged in a protective, sealed wrapping until they are to be assembled with the various components for use. After use, they may be discarded or easily dismantled for cleaning, resterilization and reuse. Removal of the locking cap, such as caps **68** and **110,** permit dismantling.

While the particularly described embodiments of manifolds **10, 44** and **88** have referred to applications in the medical field, the use of these manifolds can be widespread. For example, manifolds of this type can be used wherever there is a need to measure pressures and transfer liquids or gases. This could be in experimental endeavors or in an actual manufacturing environment. It is to be further understood that the use of the term fluid herein refers to liquid as well as gas.

Obviously, many modifications and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A protection manifold, which comprises, means having internal passageways and associated external ports for connecting various components thereto to permit the transfer therethrough of fluids wherein at least some of said fluids are pressurized, means mounted movable and partially within and relative to said connecting means for controlling the selective connection of at least a pair of said connecting-means passageways to connect the various components connected to the external ports of the pair of passageways, and means formed in said controlling means independently of said connecting means for venting to the atmosphere a selected one of said connecting-means passageways during a period when at least two other passageways are selectively connected by said controlling means to vent the component connected to the selected one of said passageways.

2. A protection manifold as recited in claim **1,** which further comprises, means appearing partially and externally on each of said connecting and controlling means for indicating the selective positioning of said controlling means.

3. A protection manifold as recited in claim **1,** wherein said connecting means includes, a housing, at least one opening formed in said housing, a plurality of hollow stems extending from said housing and forming ports, and said ports forming a plurality of passageways in said housing with at least one passageway extending from said opening to an exterior face of said housing.

4. A protection manifold as recited in claim **1** wherein said controlling means includes, a movable valve member positioned within an opening of said connecting means, said member formed with passageways in a selected pattern so that when said valve member is selectively positioned selected passageways of said connecting means are connected through the passageways of said member.

5. A protection manifold as recited in claim **4** wherein said venting means includes, a selectively formed passageway in said movable valve member which is aligned with a selected one of said ports for the selective venting of the component connected thereto.

6. A protection manifold as recited in claim **2,** wherein said indicating means includes, pointer means formed with said movably mounted controlling means, and labels placed selectively in fixed locations on said connecting means adjacent to positions at which said pointer is positionable.

7. A protection manifold as recited in claim **1,** wherein said connecting, controlling and venting means are formed of plastic.

8. A protection manifold as recited in claim **4** wherein said movable member is rotatable relative to said connecting means to effect the selective positioning thereof.

9. A protection manifold as recited in claim **4,** wherein said movable member is slidable relative to said connecting means to effect the selective positioning thereof.

10. A protection manifold as recited in claim **1,** which further comprises, means formed in said connecting means for securing the manifold to an attaching structure.

11. A protection manifold as recited in claim **3** wherein each of said stems are formed of a different geometry to indicate the function of the component to be connected thereto.

12. A protection manifold as recited in claim **1** wherein said connecting means includes, a housing, a central and two side openings formed in one face thereof, a passageway extending between said central

opening and each of said side openings, and a pair of ports communicating with each opening;

said controlling means includes, three movable valve members being assembled within the three openings of said housing, and each of said valve members being formed with passageways which selectively connect the housing passageways and ports; and

said venting means includes a passageway formed in each of at least two of the three valve members to selectively provide a venting passageway for at least two of said ports and components connected thereto.

13. A protection manifold as recited in claim **1** wherein said ports are provided for connecting to a syringe, a pressure sensitive transducer, a fluid source and selected areas of a patient, said controlling means is selectively manipulatable relative to said connecting means to selectively connect the syringe with the fluid source or the patient areas for flushing and sampling operations, and to selectively connect the patient areas to the transducer for pressure measurement, and said venting means is connected protectively to the transducer when the syringe is connected to the fluid source or the patient.

14. A protection manifold as recited in claim **1,** which further comprises means physically connected to said controlling means for operating and controlling means to selected positions.

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