

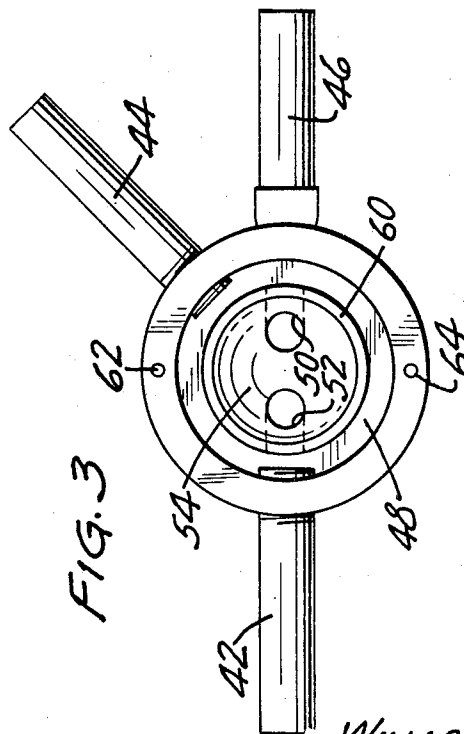
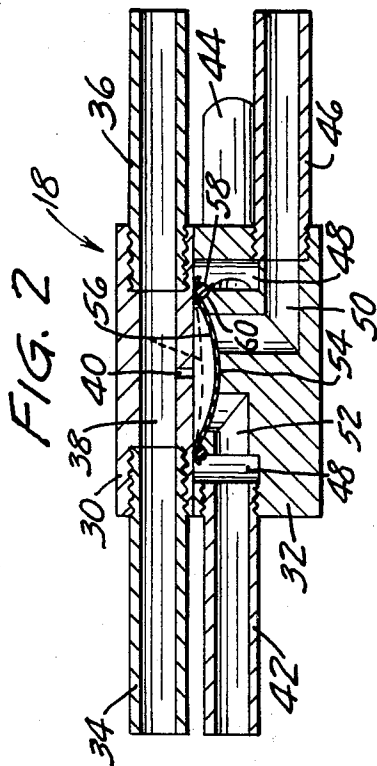
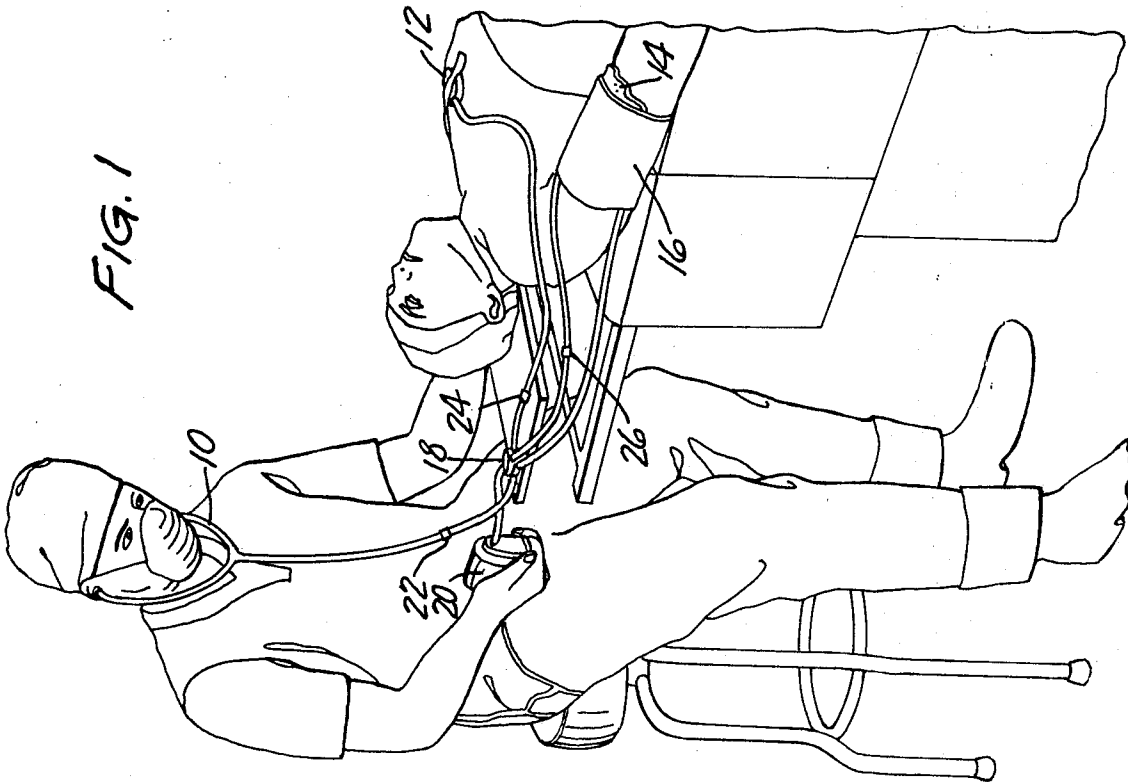
June 30, 1970

W. R. PLOSS

3,517,664

CONSTANT STETHOSCOPIC MONITORING SYSTEM

Filed March 19, 1968



INVENTOR.
WILLIAM R. PLOSS
BY *Kinney, Alexander,
Sells, Steddt & DeLaHunt*
ATTORNEYS

1

2

3,517,664

CONSTANT STETHOSCOPIC MONITORING SYSTEM

William R. Ploss, Gainesville, Fla., assignor to Minnesota Mining and Manufacturing Company, St. Paul, Minn., a corporation of Delaware
Filed Mar. 19, 1968, Ser. No. 714,226
Int. Cl. A61b 5/02

U.S. Cl. 128—2.05

4 Claims

ABSTRACT OF THE DISCLOSURE

A device for monitoring blood pressure, pulse and respiration during anesthesia, having a two-way valve in which the passage from a blood pressure acoustic pickup to the earpiece is always open, but a pressure activated valve closes off the passage from a chestpiece to the earpiece automatically in response to inflation of the blood pressure cuff.

This invention relates to a constant monitoring stethoscope system and a valve therefor.

Numerous methods and devices for monitoring vital functions of a patient are available to the anesthesiologist. Because many other uses of the hands are required, the conventional "finger on the pulse" method is often less than desirable. Although electronic devices are available for monitoring virtually any measurable function of the body, most are quite expensive and often inconvenient for application on a routine basis. Many of these devices also give visual signals which take the anesthesiologist's attention away from the patient and the progress of the surgery. The need for an acoustic constant monitoring system has become recognized. See, for example, "Stethoscope Monitoring During Anesthesia," Joseph F. Patterson, M.D., *Anesthesia and Analgesia*, vol. 45, No. 5, pages 472-475 (1966). One form of a dual monitoring system was described in "A Simple Constant Monitor System," R. E. Ploss, *Anesthesiology* 16:466 (1955). The described system included a chestpiece and a blood pressure acoustics pickup, both connected to the same earpiece in which a manually operated clamp was provided to cut off the sound from the chestpiece.

The present invention provides a constant monitoring system which permits continuous acoustic observation of vital function during surgical anesthesia. Thus the invention makes possible the immediate recognition of bradycardia, arrhythmias and cardiac arrest. The invention further facilitates heart sound and blood pressure determinations while allowing the anesthesiologist comfortable, free movement, and maximum observation of the patient and the surgical procedure.

Briefly summarized, the invention provides a constant monitoring stethoscope in which the earpiece is connected both to a chestpiece and a blood pressure acoustic pickup through a valve. The valve is also interconnected with the tube leading from the inflator to the blood pressure cuff in such manner that the passage from the chestpiece to the earpiece is automatically closed off when pressure is applied to the blood pressure cuff. The preferred valve of this invention is a diaphragm valve which is closed in response to pressure in the blood pressure cuff inflation system.

The invention will be further explained with reference to the accompanying drawings wherein:

FIG. 1 is a pictorial representation illustrating the monitoring system of this invention, and illustrating the manner in which it is used;

FIG. 2 is a cross-sectional view of a valve of this invention; and

FIG. 3 is a top view of the bottom portion of a valve of this invention.

Referring more particularly to FIG. 1, it is seen that the system of this invention includes earpiece 10 which may be either a monaural or binaural earpiece, a chestpiece 12, a blood pressure acoustic pickup 14 which is suitably positioned within blood pressure cuff 16. Chestpiece 12 and acoustic pickup 14 are both connected by means of suitable tubing to earpiece 10 through a switch valve 18 of this invention. Blood pressure cuff inflating means 20 which may be a manometer or hookup to a semi-automatic inflator, is connected to blood pressure cuff 16 by means of a conduit which also passes through valve 18. Valve 18 contains means which closes off the connection between chestpiece 12 and earpiece 10 in response to the application of pressure in cuff 16. The various tubing means can be provided with quick disconnect couplings, as indicated for example by numerals 22, 24 and 26. By means of these couplings, the various elements of suitable tubing to earpiece 10 through a switch valve 18 can be disconnected at coupling 24 and easily replaced by an esophageal pickup. Other similar substitutions will be apparent to those skilled in the art.

As shown in FIG. 2, valve 18 in its preferred form is comprised of a top portion 30 through which inflating air for the blood pressure cuff passes, and a bottom portion 32 through which the stethoscope is connected to the various acoustic pickup means. The top portion 30 is provided with a nozzle 34 connected to a source of air for inflating the blood pressure cuff and a second nozzle 36 which leads from the valve to the blood pressure cuff. The nozzles are freely interconnected by a passage 38 which has a small, preferably circular, passage 40 leading to the lower half of the valve 32 for actuating the valve as will further be explained hereinafter.

Lower half 32 of the valve is provided with a nozzle 42 which leads from the valve to the earpiece, a second nozzle 44 which is provided for connection of the valve to the blood pressure acoustic pickup means, and a third nozzle 46 for connection to the valve to a chestpiece, or if desired an esophageal pickup. Each of the nozzles is adapted to be encircled by a suitable elastomeric tubing which connects the various elements to the valve. As seen in FIGS. 2 and 3, nozzles 42 and 44 are always interconnected, i.e., there is free passage there by means of the open portion 48 of the lower valve portion. Since the pulse sound is heard only when the blood pressure cuff is inflated, there is no sound interference at times when the blood pressure is not being measured. Nozzles 42 and 46 are interconnected by means of conduits 50 and 52 and through dish-out portion 54.

An elastic diaphragm 56 separates opening 40 from the lower portion of the valve. When no pressure is being applied to the blood pressure cuff, the diaphragm 56 assumes the position shown by the dotted lines and thus the passageway between nozzles 42 and 46 is normally open so that sounds from the chestpiece are transmitted to the earpiece. However, when pressure is applied to the blood pressure cuff, diaphragm 56 is pressed downward as shown in FIG. 2 by means of air pressure applied through opening 40, thus closing off passages 50 and 52. An O-ring 58 or equivalent sealing means can be used for holding diaphragm 56 tightly in place. As shown in FIG. 2, it is preferred that O-ring 58 holds the outer periphery of diaphragm 56 against the lower part of valve portion 30 and is held in position by a curved portion 60 which surrounds the dish-out portion 54 which interconnects conduits 50 and 52. Upper portion 30 and lower portion 32 of the valve can be held together by any conventional fastening means. For example, as shown

3

in FIG. 3, the lower portion 32 can be provided with threaded tapped holes 62 and 64 so that the upper and lower portions can be held together by means of screws. If desired, a sealant can be applied between the two portions before assembly to provide an airtight seal.

While the preferred valve contemplates the use of diaphragm 56 for closing off passage between the chestpiece and earpiece upon application of pressure to the blood pressure cuff, it will be apparent to those skilled in the art that other pressure-responsive switch means can be substituted therefor. For example, an upwardly spring urged piston could be substituted for diaphragm 56. Other substitute valve mechanisms will be apparent to those skilled in the art.

What is claimed is:

1. A constant monitoring stethoscopic system having an earpiece, at least two acoustic pickup means, a blood pressure cuff, and an inflating means therefor, said acoustic pickup means being interconnected with said earpiece by means of conduits which pass through a valve; said blood pressure cuff and said inflating means being interconnected by means of conduits which also pass through said valve, said valve being capable of closing off interconnection between said earpiece and at least one of said pickup means upon inflation of said blood pressure cuff, said valve having normally open channels for passage from said acoustic pickup means to said earpiece, a separated channel for passage of inflating gas from said inflating means to said blood pressure cuff, and closing means activated by said inflating gas for shutting off one of said channels from said acoustic pickup means to said earpiece when there is superatmospheric pressure in said inflating gas channel, said closing means being resiliently urged to return to its normal position when said superatmospheric pressure is removed from said inflating gas channel thereby reopening the channel from the acoustic pickup means to the earpiece.

2. A system according to claim 1 wherein said closing means comprises an elastic diaphragm which separates the inflating gas conduit from the closable conduit between

4

said earpiece and said acoustic pickup means, said diaphragm being seated over an enlarged portion in said latter conduit, superatmospheric pressure in said inflating gas conduit being capable of causing said diaphragm to conform to the surfaces of said enlarged conduit portion, thereby closing said conduit, removal of said superatmospheric pressure from said inflating gas conduit permitting said diaphragm to return to its normal position, thereby reopening said channel from said acoustic pickup means to the earpiece.

3. A system according to claim 2 wherein said enlarged conduit portion is a smooth-surfaced, dished-out area in said valve, said diaphragm being seated to seal off the open side of said dished-out portion whereby the conduits leading from said acoustic pickup means to said earpiece form a completely enclosed system.

4. A system according to claim 3 wherein said diaphragm is sealed into position by a gasket means which encircles said dished-out portion and is compressed between the periphery of said dished-out portion and the part of the valve housing which contains said inflating gas channel.

References Cited

UNITED STATES PATENTS

1,600,296	9/1926	O'Malley	128—2.05
2,902,108	9/1959	Briskier	181—24
3,348,535	10/1967	Gregg	128—2.05

OTHER REFERENCES

Anesthesia and Analgesia, vol. 45, No. 5, pp. 472-475 (1966).

Anesthesiology, vol. 16, pp. 466-467 (1955).

RICHARD A. GAUDET, Primary Examiner

K. L. HOWELL, Assistant Examiner

U.S. Cl. X.R.

181—24

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,517,664 Dated June 30, 1970

Inventor(s) William R. Ploss

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In Column 2, delete line 20, "means of suitable tubing
to earpiece 10 through a switch"
and insert
-- ments of the combination can be modified easily. For ex-
-- .

SIGNED AND
SEALED
NOV 3 1970

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents