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SPHYGMOMANOMETER

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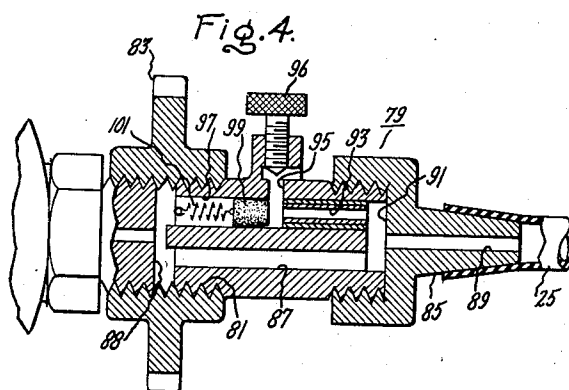
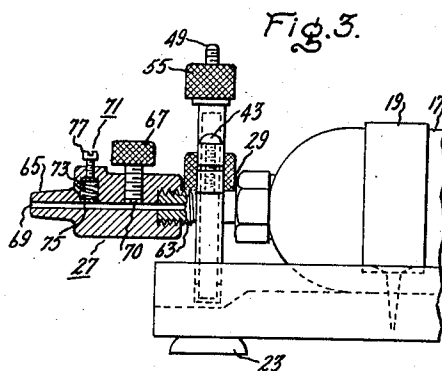
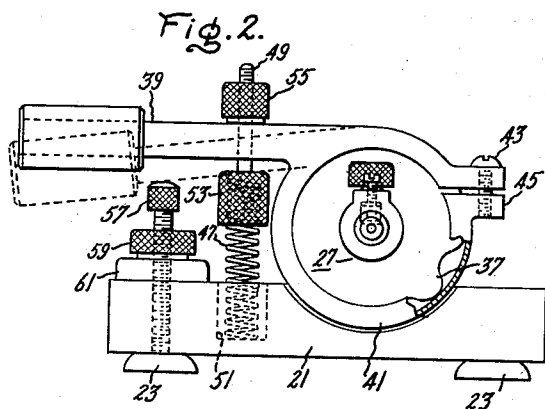
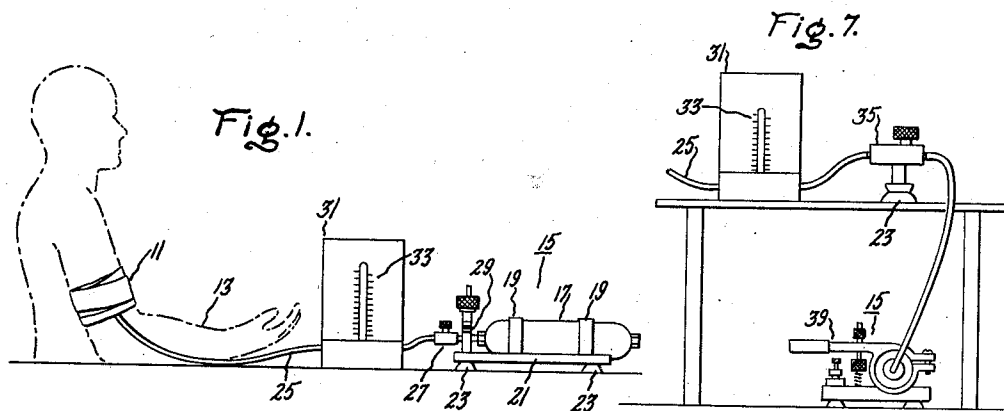


Fig. 5.

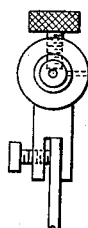
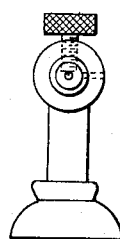


Fig. 6.



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SPHYGMOMANOMETER

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This invention relates to measuring devices and more particularly, to such devices for measuring the blood pressure, commonly known as sphygmomanometers.

Sphygmomanometers, or blood-pressure measuring devices, are well-known. Usually, a flexible pneumatic bandage, or cuff, is wound around an arm of a patient and fluid under pressure is then forced into the cuff. Conventionally, a flexible reservoir is manually operated to force air into the cuff. The pressure exerted on the extremity by the fluid from the reservoir is raised beyond the diastolic and systolic blood pressures. The so-called diastolic blood pressure is the pressure at which the pulse beat becomes evident as a pulsation in the manometer reading. The systolic blood pressure is the pressure level wherein the pulsation in the manometer reading due to the pulse beat disappears. After the pressure created by the cuff, as indicated by the manometer, has been raised beyond the systolic level, the air is allowed to slowly escape from the bulb by manually adjusting a valve. When many blood-pressure readings are successively taken, the effort expended in manually pumping air into the cuff from the flexible reservoir is great.

Further, hand pumping of air into the cuff raises the pressure exerted on the extremity by irregular increments, and consequently, the cuff pressure must be elevated more than would otherwise be necessary in order to read the systolic pressure during the release of the cuff-pressure.

Accordingly, it is an object of the present invention to provide means for automatically and evenly raising the cuff pressure of a sphygmomanometer.

It is a further object of the present invention to provide means for enabling the air to be slowly released from the cuff automatically after the reservoir has been closed so that no steps are required of the operator other than the opening and closing of the reservoir.

Most physicians already possess blood-pressure measuring devices comprising a cuff, a manometer, and a flexible reservoir. Therefore, an automatic device is desirable that utilizes this existing equipment.

Accordingly, it is another object of the present invention to provide an automatic device for cooperating with existing cuffs and manometers for reading blood pressure.

Many of the present manometer scales have an upper pressure limit between 260 and 300 millimeters of mercury, and any pressure exerted in the scale that is appreciably greater than this maximum reading is likely to damage the scale.

Therefore, it is still another object of the present invention to provide pressure-release means for preventing the pressure exerted by the pressure on the manometer from exceeding the maximum indication of the manometer.

Further, the device for measuring pressure should be operable by foot or by hand since some operators such

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as anesthetists, must have their hands free to operate the equipment.

Hence, it is yet another object of the present invention to provide a blood-pressure measuring device having means for adapting it for operation by foot or by hand pressure.

The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description when taken in connection with the accompanying drawing wherein:

Fig. 1 is a front view of the present invention as it is arranged during operation thereof;

Fig. 2 is an enlarged end view, partly in section, of the pressure-supply segment of the invention illustrated in Fig. 1;

Fig. 3 is an enlarged front view, partly in section, of the device illustrated in Fig. 2;

Fig. 4 is an enlarged cross-sectional view of another embodiment of a valve structure for controlling the pressure applied to the manometer and which is automatic in its operation;

Figs. 5 and 6 illustrate various means for attaching the pressure-control valve to a table; and

Fig. 7 is an end view of the embodiment illustrated in Fig. 1.

In the drawings, now preferred embodiments of the present invention are shown only by way of illustration and not by way of limitation.

Referring now to Fig. 1, a sphygmomanometer, or blood-pressure measuring device, embodying the principles of the present invention is therein shown comprising generally a cuff or pneumatic bandage 11 which is wrapped securely around an arm 13 of the patient. Fluid under pressure is supplied to the cuff 11 from a suitable reservoir 15, here shown as a cylinder 17 containing a fluid such as compressed carbon dioxide. The cylinder 17 is attached by bands 19 to a base 21. The base 21 is supported on a desk or table by feet 23 which may, for example, be suction cups. The fluid from cylinder 17 is supplied to the cuff 11 through a flexible tube 25 and control valves 27 and 29. The pressure built up in the cuff 11 is indicated by a suitable manometer 31 having a scale 33.

If desired, the base 21 and the associated structure can be placed on the floor beneath the desk or table, as indicated by Fig. 7. If such an arrangement is utilized, an additional valve 35 (Fig. 7) is supported on the table top by any suitable means such as are illustrated by Figs. 5 and 6. The valve 35 is similar to the valve 27 except that tube connections are available at both ends thereof.

Attention is next directed to Figs. 2 and 3 for a detailed description of the control valves of the present invention. The valve 29 attached to the reservoir 17 is any suitable type of valve such as a needle valve and is operated by turning a wheel 37. A clockwise motion of the wheel 37 closes the valve 29 and conversely, a counter-clockwise motion of the wheel 37 opens the valve 29. A lever arm, or operating handle 39, is attached to the wheel 37 by a clamping band 41 and clamping screw 43. To fasten the operating handle 39 on the wheel 37, screw 43 is advanced in a threaded flange 45 on band 41. Since the operating handle 39 is detachable from the wheel 37, the cylinder 17 and valve 29 may be a standard carbon dioxide cylinder and valve, such as are commercially available. Thus, the cylinder 17 can be readily replaced when its contents are exhausted.

Suitable means are provided for urging the operating

handle 39 in the clockwise, a closed position, here shown as a spring 47 mounted on a post 49 extending upwardly from the base 21. The spring 47 is positioned in an aperture 51 in the base 21 and is held therein by a retaining cap 53 which is slidably mounted on the post 49. A lever stop 55 is threadably engaged on the post 49 to retain the handle 39 and spring 47 on the post 49.

Means are provided for limiting the motion of handle 39 in the counterclockwise, or open, direction so that the associated manometer is not damaged by an excessive surge of fluid from the reservoir 17. Here such means are illustrated by set screw 57 which is threadably engaged in the base 21. The set screw 57 can be locked at any desirable height, corresponding to a desirable maximum pressure indication of the manometer 31, by a lock nut 59 which is in contact with a flange 61 on the base 21. It is desirable to utilize adjustable limiting means because presently-available manometers are of two types, namely a mercury manometer and aneroid manometer. The maximum readings of these two types of manometers differ, thereby requiring different settings of the set screw 57.

As mentioned above, it is sometimes desirable to adapt the sphygmomanometer to foot operation, instead of the usual hand operation. When foot operation is utilized, the tension exerted on handle 39 by spring 47 is adjusted by advancing lever stop 55 toward base 21 and readjusting the position of handle 39 relative to wheel 37. Thus, an increased spring tension is utilized corresponding to the increased pressure exerted on handle 39.

The valve 27 is interposed between the valve 29 and the manometer 31 to provide pressure-release means and to afford additional protection for the manometer 31. The valve 27 is threadably engaged on a nozzle 63 of valve 29. End 65 of valve 27 is adapted to receive an end of the flexible tube 25. A duct 69 extends through the valve 27. A control screw 67 is threadably engaged in valve 27 to provide means for releasing the pressure in cuff 11. When control screw 67 is turned clockwise, fluid under pressure flows from the cylinder 17 into the tube 25 under the control of valve 29. When the control screw 67 is turned counterclockwise, after valve 29 has been closed, pressure from the cuff 11 escapes from the duct 69 through an aperture 70.

A safety release 71 is provided in the valve 27 to prevent damage to the manometer 31. The safety release 71 is desirable because the set screw 57 limits only the opening of valve 29, and hence, is sufficient only to prevent a sudden excessive flow of fluid under pressure to the manometer 31. The safety release 71 prevents a slow build up of pressure within the cuff 11 to a point beyond the maximum pressure limit of the manometer 31 by an accidental retaining of the handle 39 in the open position for an extended period of time.

The safety release 71 includes a spring 73 which urges a stop 75 in a closed position. When the pressure within the duct 69 becomes greater than the maximum indication of the manometer 31, the excessive pressure forces stop 75 open. The force exerted by spring 73 on stop 75, and hence the maximum pressure within duct 69, is controlled by a set screw 77, as is desirable because of different manometer types, as mentioned above.

To observe the blood pressure of a patient, the cuff 11 is wrapped around the arm 13. The control screw 67 is turned to the off position to prevent pressure from escaping through the aperture 70. Operating handle 39 is depressed until the desired readings are observed. Operating handle 39 is then returned to the up or off position. Control screw 67 in valve 27 is then turned to the open position and the pressure in the cuff 11 escapes through the aperture 70.

Attention is next directed to Fig. 4 wherein is illustrated a modification of the present invention. This modification comprises a valve designated generally as 79 which is completely automatic in its operation and is utilized

instead of valve 27 when automatic operation is desired.

The valve 79 includes a threaded end 81 which is coupled to valve 29 by a connector 83. Opposite end 85 of valve 79 is adapted to receive the tube 25. The end 81 of the valve 79 includes an axial duct 87 which is connected from a chamber 88 to a duct 89 that leads into tube 25. The duct 87 is also connected to a transverse duct 91 that leads into a duct 93 having a restricted cross-sectional area. The duct 93 is connected to the outside by an aperture 95. The effective cross-section area of the aperture 95 is controlled by a needle valve 96. A second duct 97 is connected to the chamber 88. A piston 99 of any suitable material, such as synthetic rubber is mounted within the duct 97. The piston 99 is normally retained in a retracted position by a spring 101.

When it is desired to take a blood pressure reading while employing the automatic valve 79, the valve 29 is first opened by depressing the operating handle 39. This enables fluid from the cylinder 17 to enter the chamber 88. The fluid in chamber 88 enters duct 97 and exerts a pressure against piston 99 thereby moving the piston forward from its normally retracted position, thereby closing the aperture 95 and preventing the escaping of fluid therethrough. The fluid under pressure is conducted through duct 87, a portion of the transverse duct 91, and duct 89 to the tube 25, which is coupled to the cuff 11.

Duct 91 is also connected to duct 93, and fluid entering the duct 93 from duct 91 exerts pressure against the opposite side of piston 99 from the fluid in the duct 97, and hence, tends to force the piston 99 into the retracted position. However, as described above, the duct 93 has a restricted cross-section area which is considerably smaller than the cross-sectional area of duct 97. Thus, the force exerted on piston 99 from duct 97 is greater than the force exerted from duct 93 and the piston 99 remains in the closed position.

After the pressure in the cuff has attained the desired level, the handle 39 is released, thus closing the valve 29. The pressure in chamber 88 is reduced and piston 99 is retracted by the tension of the spring 101, thereby opening the aperture 95. The fluid in the cuff 11 then gradually escapes through duct 89, a portion of duct 91, the duct 93, and the aperture 95. This slow release of the pressure enables the desired blood-pressure readings to be taken. The set screw 96 controls the release of pressure and is set according to the preference of the operator. Since the piston 99 is operated entirely by the pressure within the valve 79, the valve 79 is completely automatic in its operation.

While specific embodiments of the present invention have been shown and described, it will of course be understood that various modifications may be devised by those skilled in the art which will embody the principles of the present invention and found within the true spirit and scope thereof.

What is claimed is:

1. An apparatus for controlling the flow of fluid from a reservoir of fluid under pressure, said reservoir having a first valve mounted therein which has a wheel handle smoothly operable from an on to an off position, to a pneumatic cuff adapted to be attached to the arm of a patient, said pneumatic cuff having a manometer connected thereto for indicating the fluid pressure within said cuff, said control apparatus comprising an operating lever attached to the wheel handle of a first valve, means for normally urging said operating lever to the off position, means for limiting the maximum flow through said first valve to avoid damage to said manometer, a second valve connected to said first valve, means connecting said second valve to a cuff to provide a fluid path therebetween, said second valve having a duct extending from said first valve to said connecting means, and means mounted on said second valve for enabling the escape of air from said cuff, said second valve including a

safety release for preventing the fluid pressure in said cuff from exceeding the maximum indication of said manometer.

2. An apparatus for measuring blood pressure comprising a pneumatic cuff adapted to be attached to the arm of a patient, a manometer connected to a cuff for indicating the fluid pressure therein, a reservoir containing fluid under pressure and having an orifice therein, a first valve connected to said reservoir to control the flow of fluid through said orifice, an operating handle on said first valve for opening and closing said first valve, means to limit the amount of opening of said first valve for preventing damage to said manometer, a second valve having a duct extending therethrough, means connecting said second valve to said first valve and providing a fluid path between said first valve and said duct of said second valve, and means for providing a fluid path between said duct in said second valve and said cuff, said second valve having first and second apertures extending to said duct, means mounted in said first aperture to control the escape of fluid from said duct through said first aperture, and safety release means mounted in said second aperture for enabling the escape of fluid from said duct when the fluid pressure therein exceeds the maximum indication of said manometer.

3. An automatic apparatus for applying fluid under pressure to a pneumatic cuff adapted to be attached to the arm of a patient and having a manometer connected thereto to indicate the pressure therein, said automatic apparatus comprising a reservoir containing fluid under pressure and having an orifice therein, a first valve for controlling the flow of fluid through said orifice and having a handle for enabling the opening and closing of said first valve, a second valve having first and second ends, means coupling said first end of said second valve to said first valve and providing a fluid path therebetween, and means connecting said second end of said second valve to said cuff, said second valve including a first duct extending from said first end of said second valve to said second end thereof, a second duct extending from said first end to an aperture in said second valve, a piston mounted in said second duct, means for normally holding said piston in a retracted position so that said aperture is open, a third duct having a smaller cross-sectional area than said second duct and extending from said aperture to said second end of said second valve, and means for controlling the effective cross-sectional area of said aperture.

4. Apparatus for taking blood pressure comprising an inflatable cuff adapted to be attached to the limb of a patient, a manometer connected to a cuff for indicating changes in gas pressure therein, and means for supplying gas pressure to said cuff, said means comprising a reservoir of fluid under pressure, and a first valve on said reservoir having a wheel handle smoothly operable from an on to an off position including means normally urging said first valve to an off position, means for limiting the maximum flow through said first valve to avoid damage to said manometer, a second valve connected to said first valve, means connecting said second valve to a cuff to provide a path of flow therebetween, said second valve having a duct extending from said first valve to said second connecting means, and means mounted on said said second valve for enabling the escape of air from said cuff, said second valve including a safety release for preventing the pressure in said cuff from exceeding the maximum indication of said manometer.

5. Apparatus according to claim 4, said fluid under pressure consisting of carbon dioxide.

6. Apparatus for taking blood pressure comprising an inflatable cuff adapted to be attached to the limb of a patient, a manometer connected to a cuff for indicating changes in gas pressure therein, and means for supplying gas pressure to said cuff, said means comprising a reservoir of fluid under pressure, a first valve on said reservoir having a wheel handle smoothly operable from an on to an off position, means for limiting the maximum flow through said first valve to avoid damage to said manometer, a second valve connected to said first valve, means connecting said second valve to a cuff to provide a path of flow therebetween, a duct formed in said second valve between said first valve and said connecting means, an aperture and a restricted duct connected to said first duct by a transverse duct, a second duct between said aperture and a chamber connected to said first duct, means in said aperture for controlling the release of pressure through said aperture, and a piston in said second duct movable to close said aperture when said first valve is opened enabling fluid to enter the chamber in said second valve from said reservoir, said piston being retracted in response to a reduction of pressure in said chamber for enabling the escape of fluid pressure through said aperture.

7. An automatic apparatus for applying fluid under pressure to a pneumatic cuff adapted to be attached to the arm of patient and having a manometer connected thereto to indicate the pressure therein, said automatic apparatus comprising a reservoir containing fluid under pressure and having an orifice therein, a first valve connected to said reservoir for controlling the flow of fluid through said orifice and having a handle for enabling the opening and closing of said first valve, a second valve having first and second ends, means coupling said first end of said second valve to said first valve and providing a fluid path therebetween, and means connecting said second end of said second valve to a cuff, said second valve including a first duct extending from said first end of said second valve to said second end, a second duct extending from said first end to an aperture in said second valve, a piston mounted in said second duct, means for normally holding said piston in a retracted position so that said aperture is open, a third duct having a restricted cross-sectional area extending from said aperture to said second end of said second valve, means for controlling the effective cross-sectional area of said aperture comprising a needle valve, and means comprising a spring and a lever stop for normally urging said first valve to an off position, and means for limiting the maximum flow through said first valve to avoid damage to said manometer.

References Cited in the file of this patent

UNITED STATES PATENTS

2,053,383	Telson et al. -----	Sept. 8, 1936
2,608,319	Petry -----	Aug. 26, 1952
2,750,071	Ritchie -----	June 12, 1956

FOREIGN PATENTS

386,162	Germany -----	Dec. 4, 1923
509,638	Germany -----	Oct. 10, 1930
494,815	Great Britain -----	Nov. 1, 1938