Nov. 20, 1923. 1,474,853

P. A. SHEAFF

SPHYGMOMANOMETER

Filed Nov. 16, 1922 2 Sheets-Sheet 1

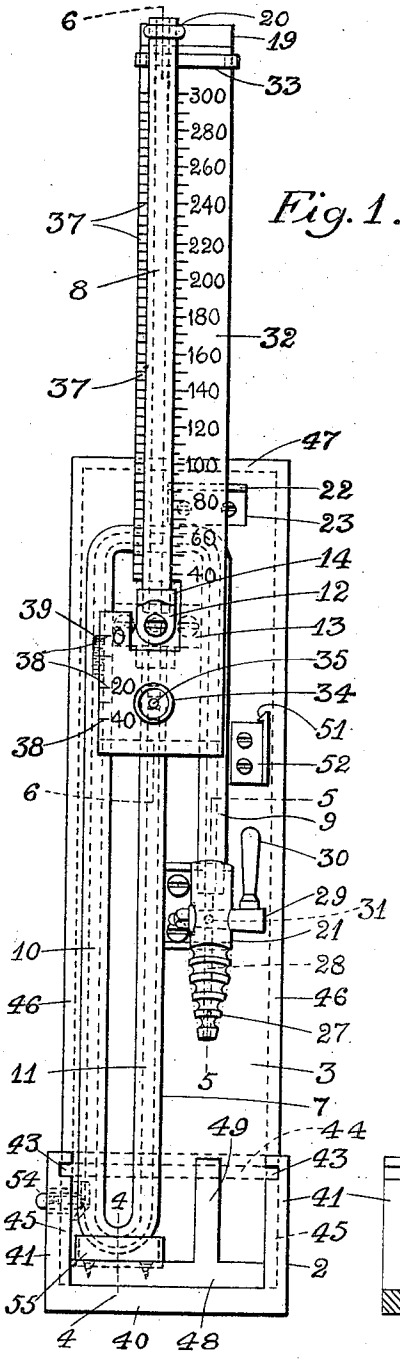



Fig. 1.

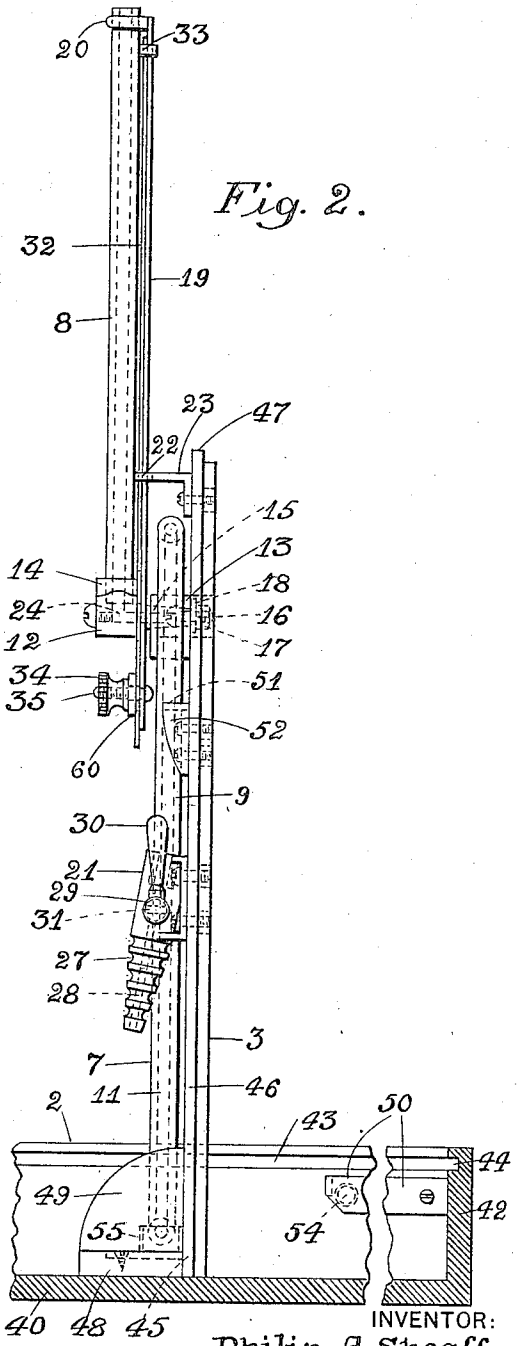



Fig. 2.

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Fig. 4.

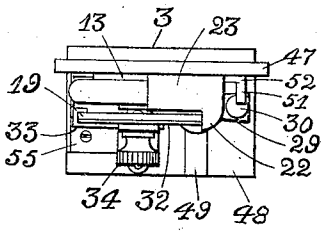



Fig. 3.

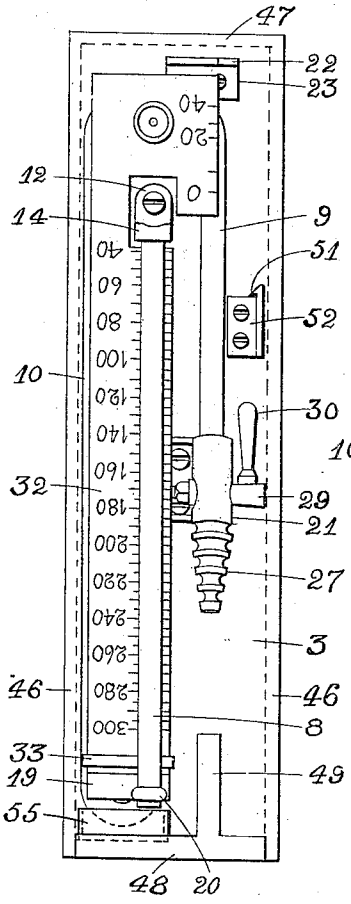



Fig. 5.

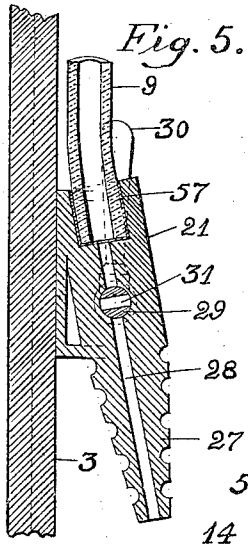



Fig. 7.

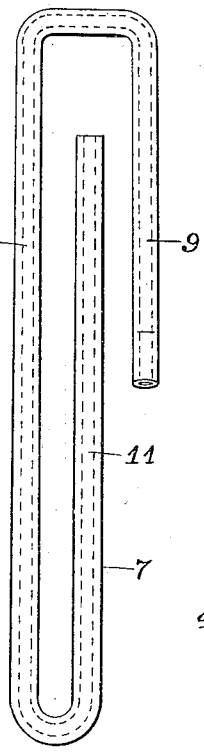



Fig. 6.

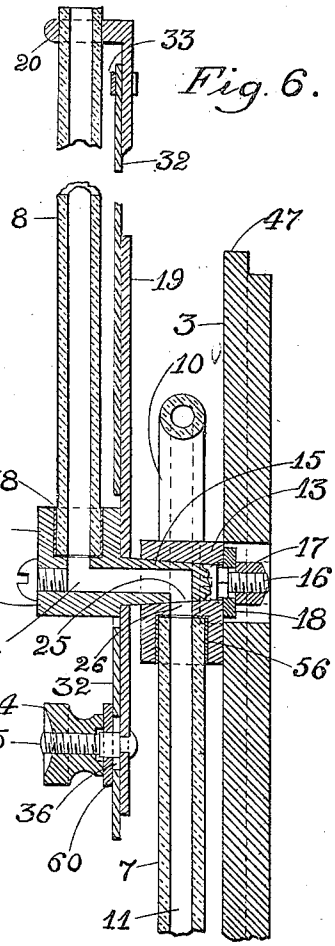
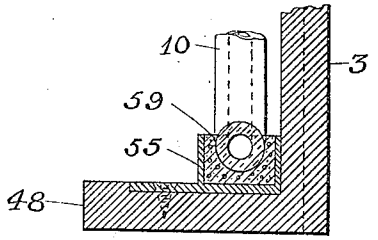



Fig. 8.




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# UNITED STATES PATENT OFFICE.

PHILIP A. SHEAFF, OF PHILADELPHIA, PENNSYLVANIA.

## SPHYGMOMANOMETER.

Application filed November 16, 1922. Serial No. 601,382.

*To all whom it may concern:*

Be it known that I, PHILIP A. SHEAFF, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Sphygmomanometers, of which the following is a specification.

The object of this invention is to provide an efficient sphygmomanometer of novel, simple and inexpensive construction which may be opened from a compact condition to provide a relatively long manometer tube for reading a wide range of variation in the results of blood pressure tests and which may be closed into a very compact condition for carrying purposes when not in actual use in testing blood pressure.

With the foregoing and related objects in view the invention consists in the novel construction, combination and arrangement of parts hereinafter described and claimed.

In the accompanying drawings, illustrating my invention,

Figure 1 is a front elevation of a sphygmomanometer embodying my invention, in the open condition thereof.

Figure 2 is a side view thereof, partly in section.

Figure 3 is a view similar to Fig. 1 omitting the supporting base or box and showing the manometer tube in the closed or folded condition.

Figure 4 is a top view of the parts shown in Fig. 3.

Figure 5 is a sectional detail of a part of the manometer tube and adjuncts, on line 5—5 of Fig. 1.

Figure 6 is a sectional detail of a part of the manometer tube and adjuncts, on line 6—6 of Fig. 1.

Figure 7 is a front view of the main pressure tube of the device.

Figure 8 is a sectional detail, showing the manner of securing a portion of one of the manometer tubes.

Referring to the drawings, 2 designates a supporting box or base and 3 a panel which rises from and is supported in a vertical position by the box 2 when the instrument is open for use in measuring blood pressure.

The panel 3 forms a support for a mercury or other liquid manometer consisting of two tubes 7 and 8.

The tube 7 is formed of a single piece of transparent glass and it comprises first, second and third members 9, 10 and 11, respectively. The first and second members 9 and 10 are spaced apart laterally and connected together at their upper ends, and the second member 10 has its lower end connected to the lower end of the third member 11, and it extends upwardlly between the first and second members 9 and 10, and terminates below the connection between them.

The second tube 8 is also formed of transparent glass and one end thereof is pivotally connected to the upper end of the third member 11 of the first tube 7 by a valve device 12. This valve device comprises a block or bracket 13 secured to the panel 3, and a head 14 forwardly of the bracket 13 and provided with a rearwardly-extending, tapered stem 15 fitted to turn in a similarly shaped opening in the bracket 13. The stem 15 is held within the opening in the bracket 13 by a screw 16 projecting from the stem 15 and a nut 17 screwed on to the screw 16 and engaging a washer 18 interposed between it and the bracket 13.

The head 14 of the valve device 12 has a plate 19 suitably secured thereto between the tubes 7 and 8 and extending away from the head 14 back of the tube 8.

The free or upper end of the tube 8, as shown in Figs. 1 and 2, extends through an opening in and is supported by a projection 20 on the plate 19, and the other end of the tube 8 is secured within an opening in the head 14.

The first tube 7 is fixedly mounted on the panel 3 by having the upper end of its third member 11 secured within an opening in the bracket 13, and by having the lower end of its first member 9 secured within an opening in a bracket 21 which is secured to the panel 3.

The plate 19 serves as a handle by means of which it and the tube 8 and the stem 15 of the valve device 12 may be turned on the axis of the stem 15 relatively to the panel 3 from the position shown in Figs. 1, 2 and 6 to the position shown in Fig. 3, and back again. The tube 8 and plate 19 are set forwardly of the tube 7 so that, when they are moved laterally to either of the positions shown in Figs. 1 and 3, they may move in front of the tube 7. When the tube 8 and plate 19 are moved to the position shown in

Figs. 1 and 2, the plate 19 is stopped by its engagement with a projection 22 on a bracket 23 secured to the panel 3, thereby stopping the tube 8 in a true vertical position.

The second tube 8 communicates with a passage 24 in the head 14 and stem 15 of the valve device 12, and the end of the passage 24 away from the tube 8 terminates in a lateral branch 25 which is adapted to be moved into and out of registry with a passage 26 in the bracket 13 with which the third member 11 of the tube 7 communicates, so that when the tube 8 is raised to the position shown in Figs. 1, 2 and 6, the branch 24 will be brought into registry with the passage 26 to establish communication between the tubes 7 and 8, and that when the tube 8 is lowered to the position shown in Fig. 3, the branch 25 will be moved out of registry with the passage 26 to close communication between the tubes 7 and 8.

The bracket 21 has a nipple 27 formed thereon and it is provided with a passage 28 extending through the body of the bracket and the nipple and forming a continuation of the passage in the tube 7. The passage 28 is interrupted by a tapered valve 29 having an operating handle 30 and a transverse passage 31 adapted to be moved into and from registry with the passage 28 to open and close the same as desired.

The nipple 27 is adapted to receive one end of a suitable, flexible tube which communicates with the air sack of the tourniquet and with the pump or air supplying device which are used in connection with sphygmomanometers and which are well known in this art.

The plate 19 carries a scale 32 for reading the height of a liquid column in the tube 8 and scale markings 38 for reading the height of a liquid column in the second member 10 of the tube 7. The scale 32 comprises a stiff sheet of celluloid or other suitable material arranged in front of the plate 19 and having suitable markings and indicia on its forward face, as will be presently described. The upper end portion of the scale 32 is slidable between the plate 19 and a strap 33 which embraces the scale and has its ends secured to the back of the plate 19. The lower end portion of the scale 32 is clamped to the plate 19 by a head 34 screwed on to a pin 35 which is carried by and which extends from the plate 19 and through a slot 36 in the scale 32. By loosening the head 34 the scale 32 may be adjusted vertically relatively to the tubes 7 and 8 when the instrument is open as shown in Figs. 1, 2 and 6. One edge portion of the scale 32 extends adjacent to the tube 8 and is provided with a series of scale markings 37, and another edge portion of the scale 32 extends adjacent to the member 10 of the tube 7, when the instrument is open, and is provided with a series of scale markings 38. The scale 32 has indicia thereon which increases in value upwardly and which is arranged adjacent to the markings 37 for reading the pressure indicated by the height of a liquid column in the tube 8; and the scale 32 has indicia thereon which increases in value downwardly and which is arranged adjacent to the markings 38 for reading the pressure indicated by the height of a liquid column in the tube member 10.

The tubes 7 and 8 are provided with mercury 39 or other suitable liquid which rests normally within the second and third members 10 and 11 of the tube 7 with its level at the scale marking 38 adjacent to "0" on the scale. When air pressure is introduced to the first member 9 of the tube 7, the mercury is forced down in the tube member 10 and through the valve device 12 and up into the tube 8 a distance corresponding with the pressure of the air within the tube member 9, and the indicia on the scale 32 indicates the pressure represented by the liquid level at the adjacent scale markings. The readings for the two liquid levels in the tube 8 and tube member 10 should correspond when duplicate numbers in the indicia are present; that is to say, when the level of the liquid column in the tube 8 is at "40," the level of the liquid column in the tube member 10 also should be at "40." If upon examination of the instrument the readings do not occur thus, the head 34 is loosened and the scale 32 is adjusted vertically to correct the error before blood pressure tests are made.

The provision of the two sets of scale markings 37 and 38 and the indicia adjacent thereto which increases in value upwardly for the markings 37 and downwardly for the markings 38 is an important improvement in an instrument employing a pivotal connection between the two tubes through which a column of liquid is forced upwardly by the air pressure, because it enables one to read the low pressures by the liquid level within the tube member 10 and the high pressures by the liquid level within the tube 8, and provides for the very accurate setting of the scale 32 relatively to the liquid levels.

The box 2 forming the supporting base of the instrument, as shown in Figs. 1 and 2, is adapted to receive and enclose the parts carried by the panel 3 when the instrument is not in use, and the panel 3 is adapted to serve as a lid for the box.

The box 2 comprises a bottom wall 40, side walls 41 and an end wall 42. The side walls 41 and end wall 42 have horizontal grooves 43 and 44, respectively, formed in the inner portions thereof near the top of the box, and the central portions of the side

walls 41 have oppositely arranged, vertical grooves 45 formed in the inner portions thereof and crossing the grooves 43.

The length of the body of the panel 3 is substantially equal to the length of the box 2 exclusive of the end wall 42, and the width of the body of the panel 3 is substantially equal to the space between the side walls 41 of the box. The sides of the panel 3 have outwardly extending ribs or flanges 46 adapted to enter either the grooves 43 or the grooves 45 in the side walls 41 of the box, and one end of the panel 3 has an outwardly extending rib or flange 47 adapted to enter the groove 44 in the end wall 42 of the box. The other end of the panel 3 has a wall 48 extending therefrom at right angles thereto and provided with a brace or stiffening rib 49 extending from it to the panel 3. The width of the wall 48 is substantially equal to the space between the side walls 41 and it extends from the body of the panel a distance equal to the depth of the box 2 below the grooves 43 in the side walls thereof.

When the instrument is open for use, as shown in Figs. 1, 2 and 6, the ribs 46 of the panel 3 rest within the vertical grooves 45 of the box 2, and the wall 48 of the panel 3 rests upon the bottom of the box and extends between and is adapted to engage the side walls 41 in a manner to support the parts carried by the panel 3 in an upright position.

When it is desired to close the instrument into compact form, the panel 3 is first withdrawn from within the box 2. The plate 19, tube 8 and scale 32 are then turned down from the position shown in Fig. 1 to the position shown in Fig. 3, and the ribs 46 of the panel are slid into the grooves 43 of the box 2 with the end of the panel opposite to the wall 48 foremost. The parts carried by the panel 3 enter the box 2, the rib 47 on the forward end of the panel 3 enters the groove 44 in the end wall 42 of the box and the end wall 48 of the panel 3 enters the space between the side walls 41, and the outer surface of the wall 48 comes flush with the end surfaces of the side and bottom walls 41 and 40. Thus the panel 3 forms a cover, closing the normally open top of the box and the panel wall 48 closes the normally open end of the box, and the parts of the instrument carried by the panel 3 are confined within and protected by the parts of the closed box.

A reversal of the closing operation just described will open the instrument for use.

When the instrument is open for use, a tube to which the air sack of a tourniquet and an air pump is connected is applied to the nipple 27, the tourniquet is applied to the patient whose blood pressure is to be tested, the valve 29 is opened and the pump is operated to supply air to the tourniquet air sack and the air receiving tube member 9, all in the usual manner well known in this art.

Before closing the instrument after a testing operation, the valve 29 is closed to close one end of the tube 7. The panel 3 is held in the upright position until the tube 8 is turned down to the position shown in Fig. 3, which turns the stem 15 and closes the other end of the tube 7 and thereby confines the mercury within the tube 7 when the instrument is not in use.

A suitable spring latch 50 is employed on one side wall of the box 2 to engage a tooth 51 on a bracket 52 on the panel 3 to hold the panel in place when it is in position closing the box. The latch 50 is provided with a pin or button 54 which extends outwardly through an opening in the box to be pressed inwardly to disengage the latch 50 from the tooth 51 when it is desired to open the instrument.

The openings in the brackets 13 and 21 receiving the end portions of the tube members 11 and 9, respectively, are larger than the end portions of the tube members which are held within the openings and sealed therein by suitable sealing wax 56 and 57, respectively.

In mounting the tube upon the panel 3 the sealing wax 56 and 57 is heated and thereby rendered plastic permitting relative movement between the tube and the brackets; and, while the wax remains plastic, the brackets 13 and 21 are secured to the panel 3 after placing the connected end portions of the tube sections 10 and 11 into a box 55 which is secured on the wall 48 of the panel 3. After the sealing wax hardens the box 55 is filled with a plastic composition, such as plaster of Paris, which subsequently hardens and holds the entire tube 7 firmly in place and removes the necessity for the fine fitting between the parts which would be necessary in the absence of the sealing wax and the plastic material.

I claim as my invention:—

1. In a sphygmomanometer the combination of a support, a tube comprising first and second vertical members connected at their upper ends and a third vertical member having its lower end connected to the lower end of the said second member, a second tube, a valve device pivotally connecting one end of said second tube and the upper end of the third member of the first named tube and adapted to open and close communication between them when said second tube is raised and lowered, a scale movable with said second tube for reading the height of a column of liquid therein, and a valve for opening and closing the first member of the first named tube.

2. In a sphygmomanometer the combination of a support, a tube comprising first

and second laterally spaced vertical members connected at their upper ends and a third vertical member connected at its lower end to the lower end of said second member and extending upwardly between said first and second members and terminating below the connection between them, a valve device mounted on said support and having its rearward portion connected to the upper end of said third member and extending therefrom between said first and second members to a position forwardly thereof, a second tube forwardly of said first and second members and having one end thereof connected to said valve device, said device hingedly connecting said second tube and the third member of the first named tube and adapted to open and close communication between them when said second tube is raised and lowered, a scale movable with said second tube for reading the height of a column of liquid therein, and a valve for opening and closing the first member of the first named tube.

3. In a sphygmomanometer the combination of a support, a tube comprising first and second vertical members connected at their upper ends and a third vertical member having its lower end connected to the lower end of the said second member, a second tube, a valve device pivotally connecting one end of said second tube and the upper end of the third member of the first named tube and adapted to open communication between them when said second tube is raised and to close such communication when lowered, a scale movable with said second tube and having indicia thereon increasing in value upwardly for reading the height of a column of liquid in said second tube and having indicia thereon increasing in value downwardly for reading the height of a column of liquid in said second member of the first named tube, and a valve for opening and closing the first member of the first named tube.

4. In a sphygmomanometer the combination of a support, a tube comprising first and second laterally spaced vertical members connected at their upper ends and a third vertical member connected at its lower end to the lower end of said second member and extending upwardly between said first and second members and terminating below the connection between them, a valve device mounted on said support and having its rearward portion connected to the upper end of said third member and extending therefrom between said first and second members to a position forwardly thereof, a second tube forwardly of said first and second members and having one end thereof connected to said valve device, said device hingedly connecting said second tube and the third member of the first named tube and adapted to open communication between them when said second tube is raised and to close such communication when lowered, a scale movable with said second tube and having indicia thereon increasing in value upwardly for reading the height of a column of liquid in said second tube and having indicia thereon increasing in value downwardly for reading the height of a column of liquid in said second member of the first named tube, and a valve for opening and closing the first member of the first named tube.

5. In a sphygmomanometer the combination of a support, a tube comprising two upright members connected at their lower ends, a second tube, a valve device pivotally connecting one end of said second tube and the upper end of the third member of the first named tube and adapted to open communication between them when said second tube is raised and to close such communication when lowered, and a scale movable with said second tube and having indicia thereon increasing in value upwardly for reading the height of a liquid column in said second tube above said device and having indicia thereon increasing in value downwardly for reading the height of a column of liquid in one member of the first named tube below said device.

6. In a sphygmomanometer the combination of a support, a tube comprising two upright members connected at their lower ends, a laterally movable second tube arranged forwardly of the first named tube, a valve device pivotally connecting one end of said second tube and the upper end of the third member of the first named tube and adapted to open communication between them when said second tube is raised and to close such communication when lowered, and a scale movable with said second tube between the first named tube and the plane of movement of the second named tube and having indicia thereon increasing in value upwardly for reading the height of a liquid column in said second tube above said device and having indicia thereon increasing in value downwardly for reading the height of a column of liquid in one member of the first named tube below said device.

7. In a sphygmomanometer the combination of a box having horizontal and vertical grooves in the side walls thereof, a panel having lateral edge portions adapted to be slid into either the vertical or horizontal grooves of the box, and a pressure tube mounted on the panel and adapted to be supported in an upright position when the panel is slid into the vertical grooves of the box and to enter the box when the panel is slid into the horizontal grooves of the box.

In testimony whereof I affix my signature hereto.

PHILIP A. SHEAFF.