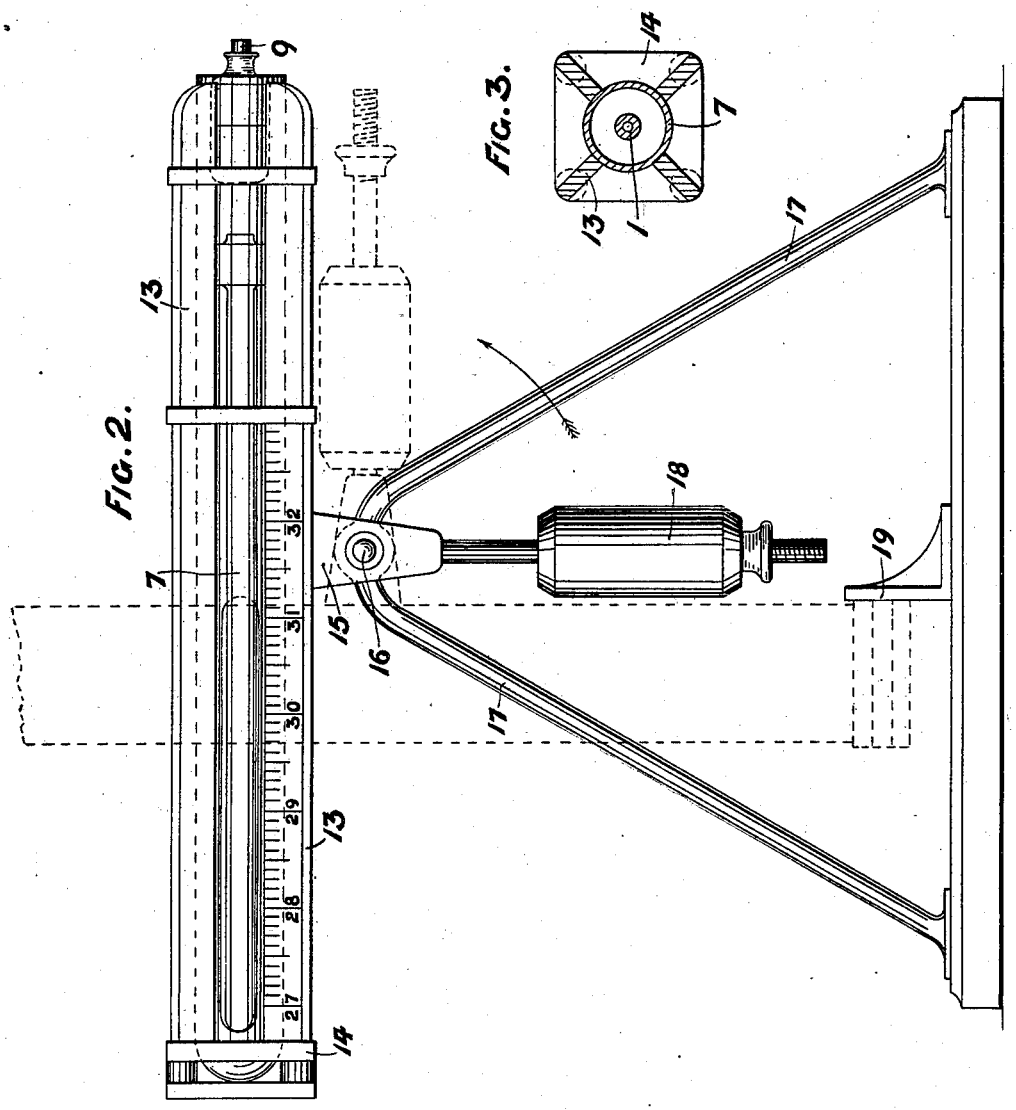
No. 676,178. Patented June 11, 1901.

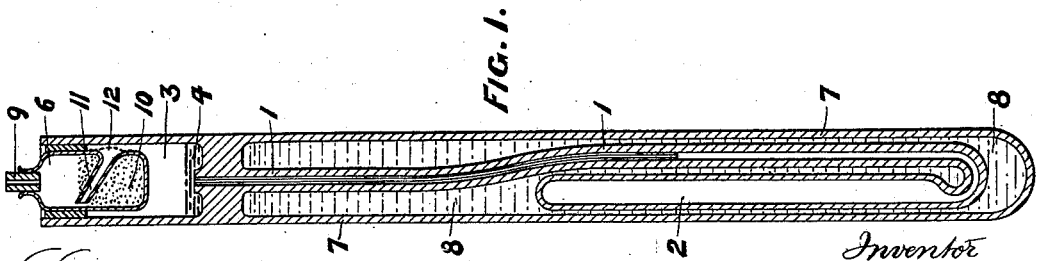
A. S. DAVIS.

MERCURIAL BAROMETER.

(Application filed Mar. 13, 1901.)

(No Model.)





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UNITED STATES PATENT OFFICE.

ARTHUR SLADEN DAVIS, OF LEEDS, ENGLAND.

MERCURIAL BAROMETER.

SPECIFICATION forming part of Letters Patent No. 676,178, dated June 11, 1901.

Application filed March 13, 1901. Serial No. 50,944. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR SLADEN DAVIS, a subject of the King of Great Britain and Ireland, residing at St. George's School, Roundhay, Leeds, in the county of York, England, have invented a new and useful Mercurial Barometer, (for which I have made application for a patent in Great Britain, No. 16,285, bearing date September 13, 1900,) of which the following is a specification.

The ordinary mercurial barometer, consisting in its simple form of a vertical glass tube hermetically sealed at the top and opening at its lower end into a reservoir of mercury, is not capable of being transported from place to place without great care and much risk of accident, and, moreover, is as usually constructed of considerable size, inconvenient to handle, and expensive to manufacture.

Now the object of my invention is to obviate these and other disadvantages by providing an instrument of a size and construction which will readily allow of it being conveniently transported from place to place and of at any time being immediately brought into use without special adjustment or the exercise of special skill. With this object in view I provide a glass tube with a bulb at one end and a reservoir to contain mercury at the other end thereof, the reservoir being open to the atmosphere, and I arrange that the tube may be at one time placed horizontally, all the mercury being then contained within the reservoir while the tube and bulb are open to the atmosphere. When it is required to ascertain the atmospheric pressure existing at the moment, the tube is placed vertically and the mercury in the reservoir passes over and covers the open top of the tube and descends within same, compressing the air (which before filled the tube and bulb at atmospheric pressure) into a smaller volume, which is contained within the bulb and lower part of the tube, the volume of this contained air being by Boyle's law reduced in inverse ratio to the pressure. In carrying out this arrangement it is obvious that I can bend the tube upon itself near the air-bulb, and thereby reduce the length of the tube and the bulk of the apparatus, and in order that the construction of such a barometer may be readily understood I will describe the same with reference to the accompanying drawings, whereon—

Figure 1 is a longitudinal section of the tube with its mercury-reservoir and air-bulb complete, the same being shown in a vertical position and detached from any supporting-framework. Fig. 2 shows the same tube mounted in a convenient frame, pivoted and counterbalanced, so as to be capable of convenient operation; and Fig. 3 is a vertical transverse section showing a supporting-frame, although, as will be hereinafter understood, I do not limit myself to the particular construction of such a framework.

Referring to Fig. 1 of the drawings, 1 is the main or capillary tube of the barometer, the lower part being bent upon itself and the diameter of its internal passage beyond such bend enlarged to form the air-bulb 2, the end of which bulb or enlargement being hermetically closed. The upper part of the main tube 1 is open and extends through the base of and into a reservoir 3, containing mercury 4. Before passing through the inlet-nozzle the atmospheric air passes by way of an entrance-chamber 6 and over some air-drying medium, such as granulated calcium chlorid, ($Ca.Cl_2$.)

In the construction shown the parts are conveniently contained within an external glass casing-tube 7, the portion below the reservoir 3 being filled with water 8, intended to preserve an even temperature throughout the main or capillary tube 1, and at the upper end of the casing-tube 7 or in the upper part above the reservoir 3 is inserted an entrance-chamber case 6, into which air enters by the aperture 9. Within the entrance-chamber case 6, 10 is the calcium chlorid, conveniently held in position by an inwardly-turned exit-nozzle 11, the lower end of the exit-nozzle being fitted with a fabric, leather, or other air-permeable diaphragm 12, through which air is free to pass to the mercury 4.

Such an apparatus as has been described with reference to Fig. 1 is mounted within a suitable framework, by which it is carried, and such a framework is shown, by way of example, at Figs. 2 and 3, the apparatus being there carried by radially-extending longitudinal bars 13, connected by frames 14 and fitted about centrally with an arm 15, extend-

ing at right angles to the axis of the casing-tube 7 and pivoted at 16 to any suitable stand 17. Such a stand may, as shown, be adapted to be placed on a horizontal surface, such as a table or the like, or a stand may be made in the form of a wall-bracket, or, in fact, so formed as to render it suitable for any desired location. A counterweight 18 is fitted upon the arm 15, and a stop 19 is fixed upon the stand, so that when in the position shown at Fig. 2, where the apparatus is placed with the tube 7 horizontally, the position of the latter is maintained by the counterweight 18, which then rests at its farthest distance from the pivot 16, whereas the arm 15 may be moved about its pivot until the frame and its contained apparatus is in a vertical position and the lower end of it comes against the stop 19, as shown by the dotted lines, Fig. 2, and the said apparatus then may be retained in this position by sliding the weight 18 along the arm 15, as is also shown by the dotted lines in the drawing.

To obtain a reading of the barometer, the operation is as follows: The apparatus is normally in the position shown at Fig. 2, the mercury 4 having been caused to flow out of the tube 1, the whole of the said tube and the bulb thereof being filled with air at atmospheric pressure. The operator then turns the instrument about its pivot 16 into a vertical position and slides the weight 18 toward the pivot to cause the instrument to be maintained in the said position. As the result of this change of position the mercury 4 passes over the open upper end of the tube 1 and incloses the air therein, the mercury then passing so far down the tube until it is balanced by the increased pressure of the imprisoned air within the bulb, the volume of which is of course reduced according to Boyle's law. The reading of the barometer can then be taken by observing the position of the base of the mercurial column in the tube 1, which as the pressure or density of the atmosphere is rarer will descend and will be at a higher level when the pressure becomes greater or the atmosphere less rarefied. In order to facilitate the observation, the back of the tube 1 may be enameled white or rendered opaque, and such devices of this character may be adopted as in common with such instruments. In order that such readings may be readily taken and be comparable, I provide a scale adjacent to the tube 1—say upon one of the bars 13 of the frame, as shown at Fig. 2—and such scale may be standardized by comparison. When a reading has been obtained, the instrument may be turned to its normal position, as at Fig. 2, and when the instrument is used at some other time it is again operated, as before described, the air which is inclosed and compressed being always, as it were, a specimen or part of the atmosphere which obtains at the moment of testing, and this, I would point out, in an instrument of my construction is always the case. A fresh-measured volume of the atmosphere taken at the moment of testing is always freshly inclosed within the tube 1 by the mercurial column at the moment of operation. By this construction I am enabled to produce a very compact instrument, easily carried about, and yet an instrument which can be set up for use at any moment and which when so set up will record with accuracy and this without any preliminary adjustment or the expenditure of what may be valuable time. Moreover, the instrument can be cheaply manufactured and its construction is such as to adapt it for location in positions or places where many such instruments as ordinarily constructed would be out of place and inconvenient.

It will be remarked that the readings of the barometer are quite independent of the temperature of the outside air, a reading taken in a temperature of, say, 40° being equally accurate to one taken at a temperature of 100°.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A mercurial barometer, comprising a main tube open at one end, the other end of the main tube terminating in an enlarged closed bulb, a mercury-containing reservoir, through one end of which the open end of the main tube projects, an open air-admittance aperture at the other end of the mercury-reservoir, and means for supporting the main tube and its attached parts, so that it may be adjusted to a horizontal position to cause the mercury to be received by the reservoir and the tube left open to the atmosphere, or so that the tube and its parts may be placed vertically with the reservoir uppermost to allow the mercury to enter the tube from the latter, compress the air contained in the tube, and enable a barometric reading to be taken, by the position of the base of the mercury column, substantially as set forth.

2. In mercurial barometers, the combination with a main tube terminating at one end in an enlarged closed bulb, a mercury-containing reservoir mounted on the other end of the tube, the open end of the latter projecting through the base, and an open air-admittance aperture at the top of the mercury-reservoir; of means to prevent the contained mercury escaping through the air-admittance aperture when the apparatus is tilted, and an air-supply chamber connected to the reservoir through which chamber atmospheric air can freely pass to supply the said reservoir, hygroscopic substances in the said chamber to extract moisture from the air passing to the reservoir, and means for supporting the apparatus so that it may be adjusted to a horizontal position, to empty the mercury from the tube into the reservoir and admit air to the tube, or to be adjusted to a vertical position to allow the mercury to descend the tube, and compress the specimen of air which

has just been admitted, to allow of a reading being obtained, substantially as set forth.

3. In mercurial barometers, the combination with a main tube terminating at one end in an enlarged closed bulb, the tube being bent near the bulb upon itself, to decrease the length of space occupied, a mercury-containing reservoir mounted on the other end of the tube, the open end of the latter projecting through the base and an air-admittance aperture at the top of the mercury-reservoir; of an air-supply chamber connected to the reservoir through which air is admitted, a hygroscopic substance in the said chamber to dry the passing air, and means for supporting the apparatus, so that it may be caused to assume a position with the tube and its parts horizontal or vertical, as required, substantially as set forth.

4. In mercurial barometers, the combination with a main tube terminating at one end in an enlarged closed bulb, a mercury-containing reservoir mounted on the other end of the tube, the open end of the latter projecting through the base thereof, an open air-admittance aperture at the top of the mercury-reservoir, means for preventing the contained mercury escaping when the apparatus is tilted, and an air-supply chamber containing a hygroscopic substance through which chamber the atmospheric air can freely pass to the said reservoir; of an outer transparent tube to inclose the main tube, and water in the outer transparent tube and surrounding the main tube to preserve an equable temperature throughout the main tube, and means for supporting the apparatus so that it may be adjusted to either a horizontal or vertical position, as required, substantially as set forth.

5. In mercurial barometers, the combination with a main tube terminating at one end in an enlarged closed bulb, a mercury-containing reservoir mounted on the other end of the tube, the open end of the latter projecting through the base thereof, an open air-admittance aperture at the top of the mercury-reservoir, means for preventing the contained mercury escaping when the apparatus is tilted, and an air-supply chamber containing a hygroscopic substance through which chamber the atmospheric air can freely pass to the said reservoir; of an outer transparent tube, to inclose the main tube, and water in the outer transparent tube, and surrounding the main tube to preserve an equable temperature throughout the main tube, a framework to carry the apparatus, a scale on the framework by which the position of the base of the mercury column may be read, when the apparatus is in a vertical position, an arm extending from the framework, a pivot connecting the said arm to a suitable stand, and a movable balance-weight on the arm to maintain the apparatus, when so placed, either in a vertical or horizontal position, substantially as set forth.

In witness whereof I have hereunto set my hand in presence of two witnesses.

ARTHUR SLADEN DAVIS.

Witnesses:
GRIFFITH BREWER,
F. W. BARRACLOUGH.