April 27, 1965 A. E. EDSTROM 3,180,153

BAROMETER

Filed Aug. 17, 1962

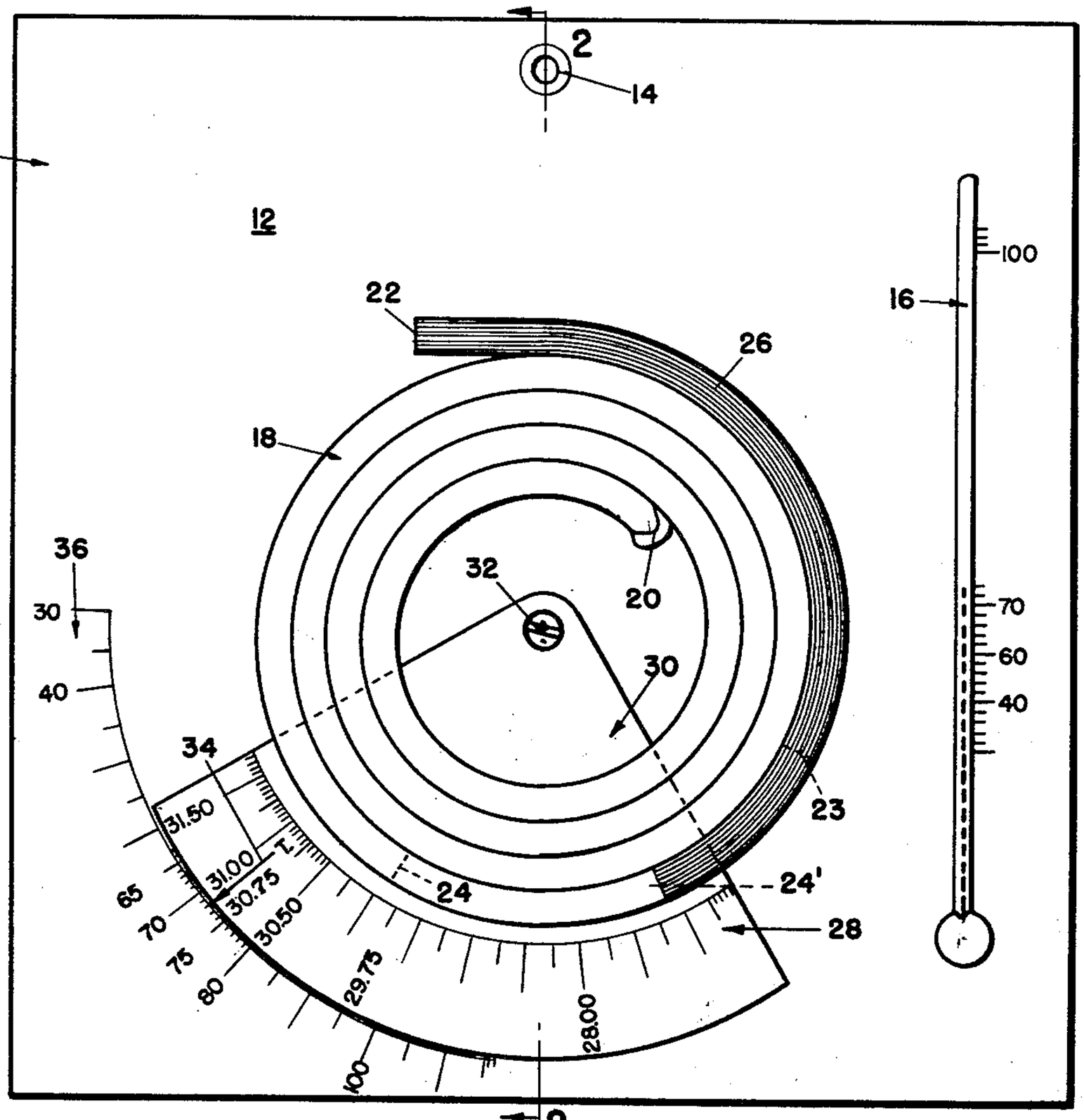

FIG-1

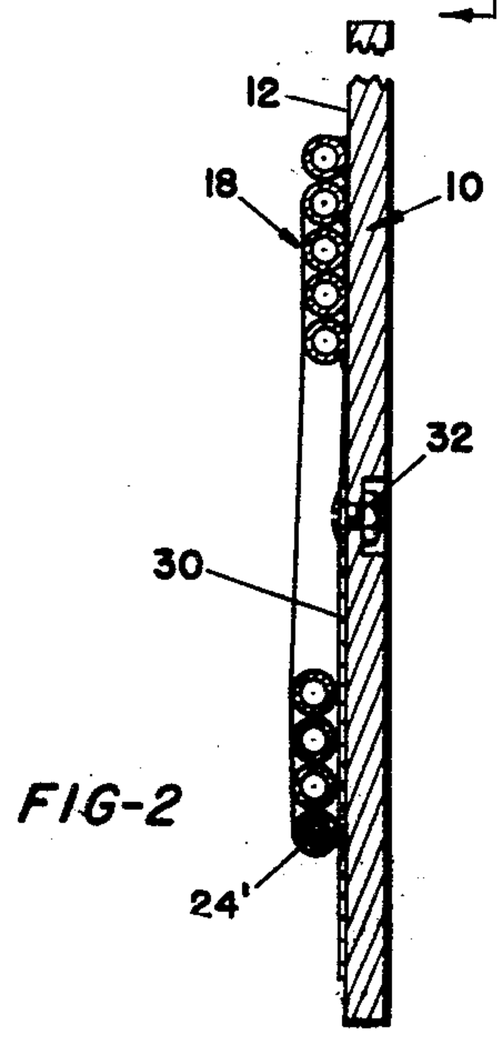

FIG-2

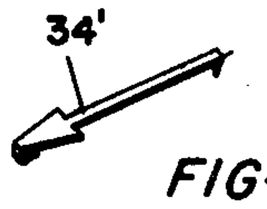

FIG-3

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1

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BAROMETER

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The present invention is a barometer having a liquid which is moved by atmospheric pressure changes and having means effective to compensate for discrepancies effected by temperature changes.

It is an object of the present invention to provide a barometer of the class described which is comparatively inexpensive and yet extremely accurate when properly adjusted.

Conventional liquid barometers normally consist of a glass tube approximately 32 inches in height containing a column of mercury and having its own open lower end immersed in a container of mercury and its sealed upper end defining a vacuumized area between said upper end and the top surface of the mercury column. Changes in air pressure on the mercury in the container cause the mercury column to rise and fall in proportion to the air pressure changes. The said conventional liquid barometer is quite expensive and also fragile, thus posing problems when shipping. Furthermore, it requires a substantial investment in a device which can be easily broken.

The present invention seeks to overcome the undesirable features of the conventional liquid barometer and yet provide a relatively inexpensive device which is virtually indestructible under normal usage and handling during shipment and yet which is extremely accurate in its operation.

In the drawings:

FIGURE 1 is a face view of my improved liquid barometer;

FIGURE 2 is a vertical section taken substantially on the plane indicated by line 2—2 of FIGURE 1 and looking in the direction of the arrow and having parts broken away for convenience of illustration;

FIGURE 3 is a perspective view of a temperature pointer.

Throughout the views of the drawings, like numerals are employed to designate like parts.

The reference numeral **10** indicates a base which is here shown to be square but which may assume other configurations if desired. In keeping with the object of maintaining the device at minimum cost, I prefer to form this base from a thick sheet of cardboard or similar substance, though obviously other materials may be employed as desired. The base **10** has a planar face **12** which is designed to be disposed in a vertical plane when the barometer is hung upon the face of a wall (not shown) by means of a screw, nail or other hanger extending through the aperture **14**.

For convenience I provide a thermometer **16** on the face of the barometer, since the temperature existing for the time being is very important to the operation of the barometer. However, it will be understood that another thermometer may be employed to enable one to be informed of the temperature existing for the time being and it need not necessarily be secured to the base **10**. An accurate temperature reading is, however, necessary to the proper functioning of the barometer as will appear hereinafter.

On the face **12** of the base **10** I have provided a spirally arranged or convolved tube **18** which has one end **20** hermetically sealed and its opposed end **22** vented to the atmosphere. Within the tube I provide a relatively small quantity of heavier-than-air liquid **24'** preferably of the non-evaporative type, the limits of which may be seen in FIGURE 1 of the drawing at **23** and **24**. The liquid is of sufficient quantity to fill the lateral section of the

2

tube and prevent air from bubbling by it and is disposed in a selected convolution of the tube **18** (here shown to be the outer convolution). It thus entraps a quantity of air between the fluid **24'** and the sealed end **20** of the convolved tube **18**.

I have employed the term "air" in this disclosure to mean any gas, the pressure of which may equalize with the atmospheric air pressure as the liquid **24'** moves in the convolution wherein it is contained.

To avoid confusion of which terminal end **23** or **24** of the liquid **24'** is to be read or compared, to determine the air pressure, I have applied an opaque material **26** for a portion of the length of the convolution which covers up the atmospheric end **23** of the liquid **24'**, so that it cannot be seen. The tube is transparent or translucent so that the liquid **24'** and its end face **24** may be seen through the tube wall.

In actual practice, I employ a length of approximately 40 inches of plastic tubing, having an inside diameter of $\frac{3}{16}$ of an inch and I color approximately 5 inches of the tube from its open end **22**. Obviously, the length of the tubing may be shortened if an enlarged area is presented in the tube between the sealed end **20** and the liquid **24'** to give a desired volume of air therein. While other liquids may be employed, in the prototype thus far described, I prefer to use an ethylene glycol anti-freeze as the liquid because of its resistance to evaporation and possession of the other qualifications set forth.

It is well known that most materials, including air, upon cooling, tend to contract and upon heating tend to expand. In this barometer it has been found that with temperature changes of 44° with a constant atmospheric air pressure, the liquid face **24** moved along the selected convolution a distance of $2\frac{5}{16}$ inches clockwise as the temperature decreased and counterclockwise as the temperature increased. A compensating means clearly must be supplied to adjust the air pressure gauge **28** so that its relative position to the liquid face **24** is adjusted in accordance with the prevailing temperature. I therefore have provided a plate **30** which is pivotally and frictionally secured to the base **10** by means of a bolt and lock-nut combination **32**. The tension of the bolt and lock-nut combination is such that the plate **30** may be rotated about the axis of the bolt and will be frictionally retained at the position to which it is manually set.

It will be noted in FIGURE 2 that the base **10** is provided with a recess in which the end of the bolt with the lock-nut **32** is contained so that the device may hang flat against a wall.

The plate **30** has pressure indicia printed thereon and constitutes a scale as seen at **28**. An arrow **34**, which is identified by the letter T may also be printed on the plate **30** to facilitate setting the air pressure scale **28** with respect to the temperature scale **36** which is printed on the face **12** of the base **10**.

In operation it will be noted that the thermometer **16**, in FIGURE 1, shows a prevailing room temperature of 72°. The plate **30** is thus manually pivoted about the pivot **32** until the arrow **34** points to 72° on the temperature scale **36**. Then, the face **24** of the fluid **24'** is compared and estimated as it relates to the pressure scale **28** and is here seen to be disposed at 29.92 which represents in the conventional mercurial barometer a column of mercury 29.92 inches long. Obviously, as the temperature increases, the plate **30** may be rotated counterclockwise to indicate the proper temperature by the arrow **34** so that the movement of the face **24** of the liquid **24'** occasioned by expansion of the air entrapped between the face **24** and sealed end **20** will be compensated for, thus the air pressure reading will remain accurate.

While I have defined the arrow T as being printed on the plate **30**, preferably it will be an independent arrow

or pointer as seen at 34' (FIGURE 3) so that the barometer may be initially prepared and then the arrow located with respect to the elevation at which the barometer is used. For example, with a temperature of 72° and an air pressure of 29.92 inches of mercury at sea level, with the present barometer used at a location which is 2,000 feet above sea level, the face 24 would indicate a lower pressure than it would at sea level by reason of the fact that the air pressure is lower. However, the air pressure readings are conventionally given by the Weather Bureau as calculated at sea level, irrespective of elevation and therefore this compensatian should be made so that the plate 30 may be set with the face 24 opposite a pressure reading of 29.92 and then the arrow 34' applied pointing to the temperature which then prevails according to the thermometer 16.

Having thus described my invention I desire to secure by Letters Patent of the United States the following:

1. A barometer, comprising:
a base;
a tube hermetically sealed at one end and having a free flowing liquid disposed within the tube, visible therethrough and entrapping a quantity of air between said fluid and said sealed end;
a temperature scale;
an air pressure scale;
means mounting the said tube, base and scales relative to each other for visually indicating the air pressure by comparing the fluid location with the air pressure scale and compensating for temperature changes by adjusting at least two of the said tube, base and scales relative to each other in accordance with the then prevailing temperature conditions; and an initially independent arrow selectively secured relative to said pressure scale and pointing at said temperature scale, whereby to compensate for elevational variations in the placement of said barometer.

2. A barometer, comprising:
a base;
a temperature scale;
a substantially spirally arranged tube carried by said base,
said tube being hermetically sealed at one end and having a free flowing liquid disposed within the tube, visible therethrough and entrapping a quantity of gas between said fluid and said sealed end;
a pressure scale arranged relative to said tube for comparing said fluid position relative thereto;
means for adjusting said pressure scale relative to said temperature scale, whereby the fluid position changes attributable to temperature changes are compensated for to effect an accurate air pressure reading on said pressure scale at said fluid position; and an initially independent arrow selectively secured relative to said pressure scale and pointing at said temperature scale, whereby to compensate for elevational variations in the placement of said barometer.

3. A barometer, comprising:
a spirally arranged substantially transparent tube disposed on a substantially vertical plane;
a plate having visual indicia mounted adjacent to said tube for arcuate movements substantially parallel to a selected convolution of said tube;
a free flowing fluid in said selected convolution arranged for visual comparison with the indicia on said plate, said tube being hermetically sealed at the end removed from said fluid the greatest distance along its convolutions;
a temperature scale associated with said plate, whereby said plate may be manually moved to a position relative to said tube as dictated by the existing temperature and the air pressure may be visually estimated by comparing the position of said fluid with said visual indicia; and an initially independent arrow selectively secured to said plate and pointing at said temperature scale, whereby to compensate for elevational variations in the placement of said barometer.

4. A barometer, comprising:
a base having a vertical planar face with a temperature scale displayed thereon;
a plate pivotally and frictionally secured to said base for arcuate movements on said face relative to said temperature scale and having a pressure scale thereon; an initially independent arrow selectively secured to said plate and pointing at said temperature scale, whereby to compensate for elevational variations in the placement of said barometer;
a substantially spirally arranged translucent tube on said base and having a selected convolution disposed substantially parallel to said pressure scale;
said tube being hermetically sealed at one end and having a free flowing liquid disposed in said selected convolution and entrapping air between said fluid and said sealed end.

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ROBERT L. EVANS, *Examiner.*