THE BAROMETER

EXPLAINED.

THE BAROMETER
AS A WEATHER GLASS.

The Barometer is an instrument for ascertaining the weight of the atmosphere, and as this fluctuates according to its dryness or moisture, so the instrument fluctuates also, and thus becomes indicative of corresponding changes in the weather. The barometer is one of the most valuable instruments ever contrived for assisting the philosopher in searching out the laws of the wonderful ocean of air in which we live.

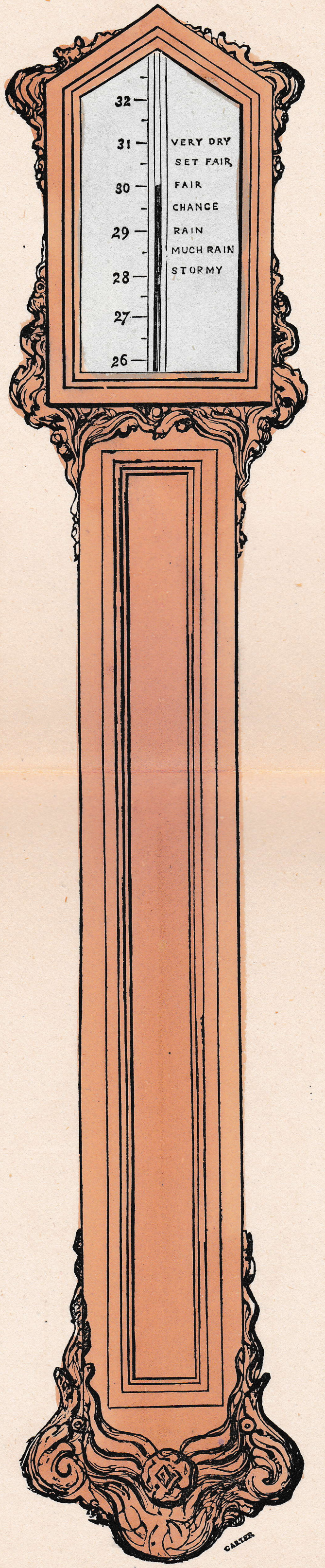
The construction of the barometer depends upon the principle, that the atmosphere at the sea-level presses with a weight of 15 lbs. upon each square inch, and that in every direction; so that if a tube be exhausted of air to prevent any counter pressure, and the end dipped in water, the weight of the atmosphere upon the water would press it into the tube, until it had attained such an height as to weigh 15 lbs. per inch surface; this column, if of water, would be 32 feet in height; but as this height would be inconvenient, mercury is substituted; this, by the same pressure, stands at a height of from 28 to 32 inches, according to the state of the air. The barometer is, therefore, a tube of glass more than 32 inches long, closed at the upper end and open at the lower; then filled with mercury and inverted into a cup of the same, which is exposed to the influence of the external air; the mercury will then stand at a certain height at the upper end of the tube, where a scale being placed, the pressure of the air is correctly indicated.

If the air contain much aqueous vapour, its pressure is increased by the tension of the vapour: at such times the barometer will stand very high. But when, on the cooling down of the air, the vapours lose their tension, the pressure of the air will of course decrease, and the mercury will fall; the condensed vapours soon after rendering themselves visible in ths form of clouds and rain.

The barometer ought to be fixed in a truly vertical position, and if possible, with a northern aspect, in order that it may be subject to as few changes of temperature as possible. Before taking an observation the instrument should be gently tapped to prevent any adhesion of the mercury to the tube. The best times of the day for observing the barometer are at 9 a.m. and 9 p.m., when it stands higher, and at 3 a.m. and 3 p.m. when it stands lower, on an average, than any other times in the twenty-four hours. Professor Daniel remarks, that those who merely consult the barometer as a weather glass, would find it an advantage to attend to the above mentioned periods, for he has noticed that by much the safest prognostications from this instrument may be formed from observing them when the mercury is inclined to move contrary to its periodical course. If the column rise between 9 a.m. and 3 p.m., it indicates fine weather; if it fall from 3 to 9, rain may be expected.

WEATHER PROGNOSTICS.

1. The most important indications of the barometer are those which depend on the *variation* of the height of the column, and not on its absolute height.
2. Generally the rising of the mercury indicates the approach of fair weather, the falling of it foul weather.
3. In sultry weather, the fall of the mercury indicates coming thunder. In winter, the rise of the mercury indicates frost. In frost, its fall indicates thaw, and its rise indicates snow.
4. Whatever change of weather *suddenly* follows a change in the barometer, may be expected to last but a short time.
5. A fluctuating and unsettled state of the mercurial column indicates changeable weather.



THE BAROMETER
AS A MEASURE OF ALTITUDE.

As we ascend above the level of the sea, the weight of the atmosphere above us decreases; and, accordingly, will balance only a column of mercury of diminished height. Thus, at the level of the sea, the medium height of the barometric column being 28 inches, at the top of Mount St. Bernard it will be only 14 inches. If the atmosphere remained always in the same state, and had at all heights the same density, the barometer would by the property just mentioned, serve as an accurate measure of the difference of levels of two stations, or the difference of their perpendicular heights above the level of the sea. For since the column of mercury suspended in the tube at each place is equal to the weight of the column of atmosphere of the same base, extending from that place to the top of the atmosphere, it would follow that the difference of the heights of the columns (reduced to the same temperature) would be equal to the weight of a column of atmosphere, whose height is equal to the difference of levels of the two places. But the density of the air is not the same at different heights. Air being elastic, each inferior stratum suffers compression from the incumbent weight of all the superior strata, and by this compression its density is increased. As we ascend in the atmosphere the quantity of superior strata is gradually diminished, and the compressing force and density is diminished in proportion. This change of density from level to level renders the computation of heights by the barometer somewhat complex, but this would cause little difficulty if the density varied according to some fixed and known law, and which would probably be the case if the temperature of the air at all elevations were the same. This, however, is not the case. The temperature decreases as the height of the station increases; but not regularly, nor according to any fixed rule. The irregular variation in temperature produces an irregular variation in density, and therefore causes an irregular variation in the change of the barometric column. Notwithstanding these irregularities, rules have been determined, founded mainly on the principles alluded to, by which the difference of levels of two places may be computed, when the heights of the barometer and thermometer at the two places are known.

As an approximation, when the barometer at the foot of an elevation is at $28\frac{1}{2}°$ and 30°, and at the top is as under, the height in feet is nearly as expressed.

At top in inches.		At foot. 28½.	30.
15	...	17,000	18,000.
16	...	15,000	17,500.
17	...	13,500	14,800.
18	...	12,000	13,250.
19	...	10,600	12,000.
20	...	9,250	11,250.
21	...	8,000	9,250.
22	...	7,000	8,000.
23	...	5,500	7,000.
24	...	4,500	5,800.
25	...	3,500	4,750.
26	...	2,400	3,750.
27	...	1,500	2,500.
28	...	500	1,750.

The barometer in the balloon in which the celebrated De Luc made his scientific voyage, fell at the greatest altitude to 12 inches. Supposing the barometer at the surface to have stood at that time at 30 inches, it follows from this, that he must have left below him in quantity three-fifths of the entire atmosphere, since 12 inches would be only two-fifths of the complete column sustained in the barometric tube.

There are several forms of the Barometer, one of the most common is that represented on the Diagram. The *Wheel* Barometer is the same in principle but differs in arrangement, the mercury, by its rising and falling, being caused to move a balanced pointer. The *Aneroid* Barometer is a recent invention, and depends for its action upon the effect produced by the pressure of the atmosphere on an elastic metallic box from which the air has been previously exhausted.

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