relative proportion of the earth and the circumambient air.

Air has weight (gravity is just the same thing, the force of gravity is the force of weight) · 100 cubic inches of air at 60° F. and with the Barometer at 30 inches. will weigh about 30 grains. So you see it has a considerable power of pressure—if taken at 50 miles high and at the above weight the force would be 15 lb. per square inch. This, in mechanics, is said to be one *atmosphere*—as you may see on the *steam gauge* of any engine: 5½ quatrillious of tons, or a ball of lead 60 miles in diameter, represents the total weight. Powerful stuff enough when bought wholesale isn't it, though it is such a thin, almost imperceptible concern, as we walk through it? If it is so heavy, why does it not all round and above us as it is, crush us to death? A man of ordinary size contains on his surface about 2000 squares inches—the air presses upon him with a force of 2000 × 15 = 30,000 lbs. and yet he is not powdered! Fortunately, in obedience to the laws of equal and contrary pressure of the air *without* and *within* the body, the catastrophe is prevented. And of what is this wondrous atmosphere composed?

It contains in every 100 parts:

	by measure.	by weight.
Nitrogen	77 5	75.55
Oxygen	21.	23.32
Carbonic Acid	0.08	0.10
Water in vapour	1.42	1.03
	100	100

Observe how the carb. ac. is proportionately heavier than bulky—how watery vapour *distends* the air.

There is no chemical combination here, merely mechanical mixture. Add the two papers of an ordinary Sedlitz powder to a glass of water, and you have chemical combination—Stir up a spoonful of sugar with a spoonful of mustard, and you have mechanical mixture.

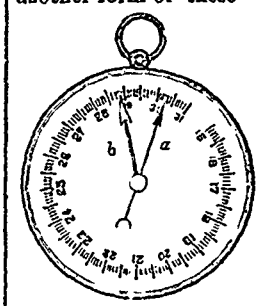
Here we are at a standstill; for we don't know anything about N. O. or C.; but let us say for the present that N., often called Azote. or life depriving. as no animal can live in it, has to be thinned by Ox. or *acid-generator*, to make our air breathable—as in N. death comes from impossibility of breathing, so in O. death ensues from rapidity of living: in N a candle won't burn, in O it burns out like fury.

These proportions in the air never vary. Animals and vegetables use the air in all places, and in using it *change* the proportions. but the sun's heat in the tropics, and their luxurious vegetation. evolve an abundant supply of oxygen, while, perhaps, the predominant existence of animals in the colder regions affords plenty of carbonic acid—this however is not certain, but at all events, whatever the source. the beneficent winds of heaven mix all the constituents of the air together, and make them fit for our inhalation.

There ought to be in every farm house in the country an instrument to measure the gravity of the atmosphere—the Barometer—I should recommend a well made aneroid as the more sensitive, tho' the upright mercurial barometer is, if large enough in the tube to overcome or lessen the friction, correct enough for all practical purposes.

Now, this instrument is founded upon a very simple theory: the column of mercury is 30 inches high, and exactly the same weight as a column of air of the same diameter, 50 miles high, and a column of water of the same diameter, 33 feet high: so that, as you may observe, the air pressing on the open end of the tube keeps the column of mercury in equilibrium. Let, however, the air become drier or more moist, and a change takes place: in the first case the Barometer rises, in the second it falls. How is this? Is dry air heavier than moist air? I answer the question by another—is a bushel of dry sand heavier or lighter than a bushel of wet sand—a bushel of dry wheat than a bushel of wet wheat? What did we find in the air besides Nitrogen, Oxygen, and Carbonic acid? a little vapour, which by weight formed 1.03 of the 100 parts; but in bulk 1.42. Moisture, then, from its excessive tenuity in the vaporous form we find it taking in the atmosphere, causes the air to occupy more space, so to speak, and therefore to become lighter—but, in dry weather, the air becomes dense, from the highly elastic vapours, and presses with increased force upon the exposed mercury. I may as well mention here that, in the common pump the same principle is called into play. The plunger, in rising when the handle is depressed, withdraws the air from the chamber of the pump; and the column of air pressing on the water of the well or tank, causes it to rise, and fills the chamber which has been exhausted of air. Theoretically 33 ft. 9 in. is the limit of the action, but practically pumps won't lift above 28 or 29 ft. The force-pump acts by both the elasticity and the pressure of the air. The ordinary force of the column of air raises the water to the 30 ft., or so, and the elastic force of the air in the condenser sends it thence 200 or 300 feet onwards, as in your fine fire-engines.

The Siphon is also dependent on the same principle. Here we have a bent tube with two unequal limbs; the greater the difference between the length of the limbs the more efficient the instrument. But to return to our Barometers: there is another form of these "weather glasses" as they are sometimes called: the aneroid from *a neros, without moisture* (1). This handy, nay, elegant little instrument is the most portable of all barometers, and, if carefully constructed, the most correct; but it should, now and then, be compared with a mercurial barometer and, if in error, corrected. Take care in buying an ordinary barometer to see that the column is large enough: if small, the mercury won't work freely; it will stick to the sides of the tube.



Aneroid Barometer.

We may as well take the Thermometer into consideration at once, and then we shall be free to attack with these weapons our great and interesting object *Meteorology*.

You all know what heat is, or rather what it does. A pint-pot will hold a pint of cold water—but by no means can you keep the liquid in the measure when it is nearly boiling; heat then expands objects. cold on the other hand, contracts them. Heat is the great opponent of gravity. If gravity acted alone, everything would be a dense solid; there could be no life. The property of heat is to part asunder the atoms of all bodies: it is invisible, and imponderable. I must harass you with a difficult phrase; "latent heat"; all bodies contain this quality or whatever you like to call it, it lies hid in them, and is brought into notice by friction. Rub two pieces of wood together and what happens? heat is evolved: whence did it come? it was there in the wood, and the friction drew this latent heat to the surface. Why? Because motion always is accompanied by heat, a law of

(1) The aneroid barometer is an invention by M. Vidi, of Paris. Its action depends upon the effect produced by the pressure of the atmosphere on a metallic box, from which the air has been exhausted: the box is then hermetically sealed. As the weight of the atmosphere increases or diminishes, the surface of the corrugated elastic box is depressed or elevated, as is also at the same time the spiral spring upon which the principal lever rests; and this motion is communicated through the levers to the *arbour* of the hand. The tension of the box in its construction is equal to 44 lbs.