Expansion of Gases.

The expansion by heat in different forms of matter, is exceedingly various.

By being heated from 32° to 212°,

1000 cubic inches of iron become 1004
1000 " water " 1045
1000 " air " 1366

Gases are, therefore, more expansable by heat than matter in the other two conditions of liquid and solid. The reason is, that the particles of air or gas, far from being under the influence of cohesive attraction, like solids or liquids, are actuated by a powerful repulsion for each other. The addition of heat mightily enhances this repulsive tendency, and causes great dilatation.

The rate of the expansion of air and gases from increase of temperature, was long involved in considerable uncertainty. This arose from the neglect of the early experimenters to dry the air or gas upon which they operated. The presence of a little water by rising in the state of steam into the gas, on the application of heat, occasioned great and irregular expansions. But in 1801, the law of the dilitation of gases was discovered by M. Gay-Lussac, of Paris, and by Dr. Dalton, of England, independently of each other. It was discovered by these philosophers, that all gases experience the same increase in volume by the application of the same degree of heat, and that the rate of expansion continues uniform at all temperatures.

Dr. Dalton confined a small portion of dry air over mercury in a graduated tube. He then placed the whole in circumstances where it was uniformly heated up to a certain temperature, and observed the expansion. Gay-Lussac's apparatus was more complicated but calculated to give very precise results. He found that 1,000 volumes of air on being heated from 32° to 212°, became 1375, which agreed very closely with Dalton's result.—The expansion was lately corrected by Rudberg, who found that 1,000 volumes of air expand to 1365.

The still more recent and exact researches of Magnus and of Regnault, give as the expansion of air from 32° to 212 deg, 366-1000, or 11-30 of its volume at 32 deg. The dilatation for every degree of Fah. is 0·002036 (Regnault); or 1-491·2 part.

It follows, consequently, that air at the freezing point expands 1-491 part of its bulk for every added degree of heat on Fah.'s scale: that is—

491 cubic inches of air at 32 deg. become
492 " " 33 deg.
493 " " 34 deg., &c.

increasing one cubic inch for every degree A contraction of one cubic inch occurs for every degree below 32 degrees.

491 cubic inches of air at 32 deg. become
490 " " 31 deg.
489 " " 30 deg.
488 " " 29 deg., &c.

We can easily deduce, from this law, the expansion which a certain volume of gas at a given temperature will undergo, by heating it up to any particular temperature; or the contraction that will result from cooling. Air at the temperature of freezing water, has its volume doubled when heated 491 degrees, and when heated 982 degrees, or twice as intensely, its volume is tripled, which is the effect of a low red heat.

A slight deviation from exact uniformity in the expansion of different gases was established by the rigorous experiments of both Magnus (Ann. de Chim. &c. 3 ser. t. 4, p. 330; et t. 6, p. 363) and Regnault (ibid. t. 4, p. 5; et t. 6, p. 370). The more easily liquefied gases, which exhibit a sensible departure from the law of Mariotte, are more expansible by heat than air, as will appear by the following table:—

Expansion upon 1 volume from 32 to 212 degs.

	Regnault.	Magnus.
Atmospheric air	0·36650	0·366508
Hydrogen	0·36678	0·365659
Carbonic acid	0·36866	0·269087
Sulphurous acid	0·36696	0·385618
Nitrogen	0·36682	
Nitrous oxide	0·36763	
Carbonic oxide	0·36667	
Cyanogen	0·36821	
Hydrochloric acid	0·36812	

The expansion is also found to be sensibly greater when the gas is in a compressed than when in a rare state; and the results above strictly apply only to the gases under the atmospheric pressure.

Effect of Alkalies on the Human System.

Messrs. Editors—Dr. Montague appears to be greatly alarmed lest the use of soda water, so called, and unfermented bread should injure the health of the community. His statements of the physiological and chemical nature and changes of the substances referred to, are so vague and mistaken that I am not surprised he should entertain this opinion.

He speaks of the effervescing drink sold as soda water as containing soda, whereas there is not a particle of soda used in the manufacture of it; the effervescence being produced by the escape of carbonic acid gas, which has been forced into pure water, the gas itself being obtained from carbonate of lime by means of sulphuric acid. I suppose the doctor's patients, whose stomachs were in a state of morbid sensibility, must have imbibed something stronger than soda water. He also thinks that bi-carb. soda, tart. acid, cream tartar, &c., used to raise bread, cake, &c., must produce the same lamentable consequences on the system, and he further accuses these substances of producing acetous fermentation, when mixed with flour. Here again he is very unfortunate in his statement of facts, for, after a very large experience on this point, I have never known this prepared flour to turn sour even in the most trying summer weather. He is equally at fault in his philosophy of the process of fermentation; this he describes as the union of moisture with the gluten of the flour; now the acid in flour is not formed from any of the particles composing the gluten, but from the sugar and starch, the gluten being transformed into an entirely different substance.

Our knowledge of the changes which our food undergoes in the system is not extensive, but we do know the changes which take place in the substances alluded to; when bi-carb. soda and tart. acid are mixed with flour, on the addition of water and heat the bi-carb. soda is decomposed, the carbonic acid escaping in the form of gas, raises the dough, the soda, uniting with the tart. acid, forms tartrate of soda; this is taken into the stomach with the bread, and in passing through the system, is again decomposed; its tartaric acid disappears, and by the addition of oxygen is converted into carbonic and water, the soda passing out of the system in the urine as a carbonate.

Thus it is evident there is no alkali to injure the gastric juice or stimulate the stomach to morbid sensibility, consequently the doctor's fears are utterly unfounded. It can scarcely be necessary to say that the class of acids to which cream tartar belongs, do not produce the injuries which the doctor specifies, for the experience of mankind is unusual that grapes, apples, &c., which contain large quantities of these acids, are wholesome fruit.

Newark, N. J. C. Dowden.

[Dr. Montague's letter appeared on page 267; he made no personal allusions, and employed no offensive language; if he entertains wrong opinions, our present correspondent's letter does not exhibit the proper spirit which should characterize a man anxious to do good, by correcting errors in others.

In respect to the so-called "soda water," sold as a summer beverage, our present correspondent is right regarding its composition, but Dr. Montague is right respecting its effect. "Its frequent repetition as a beverage," in a case within the compass of our own observation, completely destroyed the health, by injuring the stomach of a once healthy man; but Dr. M. stated that soda water, as an effervescing mixture, if taken in moderate quantities, might be useful in correcting acidity of the stomach.

Dr. M. did not say that *true fermentation* was produced by the union of moisture and an alkali with the gluten of flour. The sugar, which is never absent from true fermentation, is a product from the starch itself; it is not found in pure flour. In the manufacture of starch, a small quantity of lactic acid is produced in the steeping of the grain; this unites with the gluten and sets the starch free; alkalies are employed to produce the same effect. The vegetable fibrine in the gluten of flour is rendered soluble by alkaline liquors, and is very prone to decompose but we do not see how it is possible that such small quantities of acid, bi-carbonate of soda, and sugar, as are used in flour for quick fermentation, can be injurious to the stomach. At the same time Dr. Montague, may, in his experience, have reasons for thinking otherwise. Carbon, we know, forms a prominent part of the food of man, but it would not do to feed upon it. A correct knowledge of the best foods and drinks, beneficial and injurious to man, can only be obtained by experience. Wines are not reckoned healthy until they have deposited their bi-tartrate of soda, on the sides of the vessels in which they are contained. What is called "unfermented wine," is not wine at all.

(For the Scientific American.)

Silvering Mirrors.

I beg the privilege of offering your readers a few remarks, in reply to an article in your journal of the 25th of April, on the subject of "Silvering Glass."

The remarks by my excellent friend, the editor of the "Prattsville Advocate," and which you kindly transferred to your columns, are emphatically true. He testified of what he had seen, and they say, in this age, that "seeing is believing." Since then I have greatly improved the process in its application to large surfaces; and when I again visit the city I shall be happy to show you a reflecting surface, in which Mr. Editor, publisher, and all hands may see exactly what manner of men they are.

You refer to other inventors of processes for coating glass with pure silver. With all those processes I am perfectly familiar, having repeatedly tried them all, but always with the evidence resulting that they were impracticable on several accounts. So they have been regarded by those in Europe who purchased the rights, and the attempts to work them on a large scale have been abandoned. My process, on the contrary, is eminently practical on a scale of any magnitude: I mean that I can silver the largest glass manufactured, in a few minutes, most beautifully and completely, and that it will ever after remain pure and spotless; and that I can do this any desirable number of times with much greater certainty than usually attaches to chemical processes. My process is wholly unlike the others referred to, excepting that I use "pure silver," a circumstance which in no way affects my originality, for this much-loved article is not patentable, I imagine.

To your intimation that I am "exceedingly fortunate," and "most lucky," in making wonderful discoveries, I plead guilty. My entire time is devoted to scientific pursuits, and it is but fair that I should occasionally get a peep behind the curtain. Allow me to say that these pursuits are mostly connected with my discovery in heliochromy, and that the latter is not neglected, but will be forthcoming hereafter. This is a perplexing pursuit; but I have mastered its greatest difficulties, and shall be able to present the world a process which, in its completed state, will be easily worked, and surpassingly beautiful in its results. L. L. Hill.

Westkill, Greene Co., May 5, 1853.

[We would much rather know the process than see the mirror. We have always understood that the silvering of glass on any scale, with pure silver, was quite successful in Europe. We trust that Mr. Hill's discovery will greatly advance the art; if it is superior to the old plans it will soon supersede them. Of course we cannot form an opinion *pro* or *con*, until we know what it is.—Ed.

Circular Saws.

Messrs. Editors—Being an engineer, millwright and machinist, I am an interested reader of your able, high-minded, and interesting paper. I find it assumes to be no more than what it really is, a record of science and truth, and a fearless advocate of correct principles and valuable improvements. I am with you in exposing those apparent improvements which are founded on imaginary theories, and those which are equally as fallacious which are founded upon incorrect estimates and experiments. By this course your journal becomes a valuable instructor and a check to the wild ambition of some of the inventors and engineers of the present age. Some fearless guide—some correct standard—is needed as a beacon to warn the public against adopting too hastily the conclusions of many so-called scientific men.

I have been engaged for some time in putting up steam engines and circular saws, and I have taken the liberty to suggest an idea or two in relation to them; those I have constructed are of the kind manufactured by Hoe & Co. A great amount of time and money has been expended to bring these saws to perfection, and those who have seen them in operation will acknowledge that they are not exceeded by any in use. It is true that the same sized saw will not cut as wide plank as one without a shaft, and constructed after the manner of some of those lately patented, but in point of economy they must be quite superior; many difficulties will, I think, suggest themselves in the use of the saws without a shaft or spindle. There is too much machinery and what is used is not applied to advantage—the saw is too liable to bend, too liable to get out of repair, and does not work with the force and strength of a common circular saw; a fifty-four inch circular saw constructed after the plan of those manufactured by Hoe & Co.— (and I set no value upon those saws above others equally as efficacious)—will run six hundred revolutions per minute, cutting three-quarters of an inch to each revolution. It must, in order to accomplish this result, be put up in mechanical style, and furnished with the requisite amount of power and attention. No water is required to keep it cool when running at this rate. E. A. F.

Oyster and Clam Shell Manures.

J. H. Salisbury, State Chemist, New York, has, in the "Plow, Loom and Anvil," presented an analysis of oyster and clam shells, to which the attention of our farmers, near our coasts, should be specially directed.

"The common clam shell (Venus mercenaria)—100 parts of the dry unburned shell gave of

Silica	none.
Phosphates of iron, lime, and magnesia	1·250
Carbonate of lime	69·204
Sulphate of lime	0·815
Lime, probably combined with organic matter	13·907
Magnesia	1·400
Potassa	1·847
Chloride of sodium	6·101
Organic matter	6·050
	100·614

Shell of the common oyster (Ostrea borealis)—100 parts of the fresh shell, deprived of water, gave of

Phosphate of iron, lime, and magnesia	0·842
Carbonate of lime	86·203
Sulphates of lime	2·061
Lime, probably combined with organic matter	6·036
Magnesia	0·338
Potassa	0·191
Soda and chloride of sodium	0·690
Organic	3·613
	99·613

From these analyses it will be seen that the shells of the clam contain a much larger percentage of phosphates, magnesia, potassa, and soda, than those of the oyster, while the latter are much the richest in lime and sulphuric acid.

Soils, containing already a sufficient quantity of lime for present demands, and where the object is merely to compensate for the gradual waste, shells unburned may answer quite as good a purpose as those which have been burned. When used before burning, owing to their compact texture, they are acted upon but slowly by the ordinary agents to which they are subjected, and hence it requires a much larger quantity of them than of burned shells to exert, in a given time, the same degree of influence upon the soil. Unburned, their effects are not materially different—throwing aside the small quantity of animal matter and soluble salts they contain—from ordinary limestones broken equally fine and disposed of in a similar manner.

A locomotive engine factory has been established at Pittsburg, Pa., with a capital of $150,000. The shares are $5,000 each.