For the Scientific American.

Pneumatics.

We derive most of the names used in the sciences from the Greek; and the root of the name of this branch, which treats of aeriform bodies, is "Pneuma," which in the original signifies spirit, and was the name applied by the ancients to every thing invisible, yielding, and evanescent, and which they could neither confine in nor exclude from their rudely constructed vessels, but which still manifested its presence by its qualities, while it eluded the direct cognizance of their senses.

Pneumatics, then, is that branch of physics which treats of the properties of substances appearing in the condition of elastic fluidity; and though all solids may be reduced to this state by heat, yet most of them are so seldom the objects of observation in it, that the materials whose chemical and mechanical properties are usually described under the term pneumatics, are all included under the name of Gas, which comprehends all the invisible elastic fluids, either simple or compound, that are ponderable, and can be confined in limited space. And, as their compounds, Steam and Atmospheric Air, are the principal forms of gas, which exist naturally and can be easily procured in any quantities, and, as their mechanical properties are similar to those of all the rest, they are generally made the subjects of investigation.

The gases differ principally from solids and liquids, first:—In their great sensibility and easily yielding to the slightest pressure. Second:—In their elasticity, which is always equal to the compressing force. Third—In the great pertinacity with which they retain their latent heat, and to which they owe their gaseous state; and, fourth—In their inferior specific gravities.

If we try to move swiftly in water we encounter a rapidly increasing resistance; whereas the resistance of the atmosphere is almost imperceptible to all ordinary motions. But when the air moves with the celerity of the hurricane, its effects are often as terrific as those of a boisterous flood, showing that although it constitutes the gentle summer breeze, it can make up, by increased celerity, what it lacks in specific gravity, and commit equal devastation with an impetuous torrent of water.

Air and steam, like liquids, when compressed, press equally in all directions, with the same force. Indeed, if they did not, there would be a continual current towards the point of least pressure, exerting a force of nearly fifteen pounds upon every square inch; and we could no more resist this current of air, than we can now resist the current of a river of equal depth with the atmosphere, and flowing with a velocity as much less than that of the air, as the specific gravity of air is less than that of water.

To prove that air presses equally in all directions, compress between your hands a strong bladder filled with condensed air, and though the bladder yields, it will extend itself on the side on which there is the least pressure; and, if you puncture it, the air will rush from it in whatever direction the puncture is made, with the same force. This fact can be accounted for only upon the supposition that the particles of fluids and liquids are free to move among themselves, independent of the mass to which they belong.

Atmospheric air being one of the most compressible substances in nature, it is obvious that the atmosphere must be much more dense at the level of the sea than on the summit of high mountains; for the lower the stratum the higher, and consequently the heavier, is the superincumbent column that presses upon it; and experiments and mathematical reasoning prove, accordingly, that if the altitude above the level of the sea increases in arithmetical ratio, the difference between whose adjacent terms is seven miles, then the density of the atmosphere decreases from the earth's surface upwards, in geometrical series, whose rntio is ¼: thus—at the altitude of seven miles the air is ¼ as dense as at the surface; at 14 miles, 1-16; at 21 miles 1-64, etc. Humbold found that, on the highest peak of the Andes, he could scarcely exercise at all, because the air did not press into his lungs with sufficient force to enable him to breathe freely; and the blood-vessels became so much distended as to be ruptured in the mouth, nose, and ears of his companions. It is stated by the surgeons accompanying our army, that on the plains and in the city of Mexico, which are elevated 7,000 feet above the ocean level, consumption is scarcely known as a disease, probably because the Mexicans are necessarily in the habit of expanding their lungs, from infancy, to their utmost capacity, to inhale enough air to furnish sufficient oxygen and electricity for the uses of the animal economy; and thus their lungs gain sufficient strength to secure them against that fatal disease. Twilight ends about an hour and a quarter after sun-set, and begins an hour and a quarter before sun-rise, when the sun is nearly 18 degrees below our horizon; and were a tangent to the earth's surface drawn through the sun's centre, it would be elevated about 45 miles above us. Therefore, at this height, the air is too rare (thin) to reflect and refract the light of the sun.

From the preceding facts it is evident that the air is material, for it possesses all the essential properties of matter; and that it is an elastic fluid. To prove this still further, take a syringe with the piston drawn up, stop the tube air-tight, and then try to push the piston down, and you will soon find that there is a material and elastic substance in the syringe; for, though you can push the piston down some distance, and by so doing compress the air, the piston will recoil the moment you cease to press. To demonstrate the pressure of the atmosphere, stop the tube while the piston is down, so that no air can get into the syringe; and you will find that a very considerable force will be required to draw the piston up; and this force is proportional to the size of the piston; for the air outside of the syringe presses upon the upper side of the piston with a force of nearly 15 pounds to every square inch. The syringe must be bored true, the piston fit close, and be well oiled, to prevent the air entering beside the piston.

It has been proved, experimentally, that compressed air retains its elasticity for an indefinite length of time, and will expand when the pressure is removed, with the same force that confined it at first. Air is therefore perfectly elastic.

A vessel whose contents are 100 cubic inches, weighs nearly 30½ grains less, after the air has been exhausted (pumped out of it), than it did before; 100 cubic inches of atmospheric air, under the mean pressure of the atmosphere, therefore weigh 30½ grains.

H. R. Schetterly.

Howell, Mich.

[For the Scientific American.]

Remarks on Leather, Tanning, &c.

In No. 14 of the Scientific American, under the heading of "Recent Foreign Inventions," I see a Mr. James Pyke has taken out patents for extracting tannin, &c. Sixteen years ago I put up a steam engine in my tannery, and at the same time I built a vessel or tank (such we call it) which holds about 40 hogsheads, with the false bottom full of small holes, about four inches above the proper bottom—under this false bottom the end of the exhaust pipe from the engine is introduced, and we frequently boil the whole of the bark and liquid in from 4 to 5 hours, and generally let it cool in the leech. I don't think there has been a week in 16 years without this being done.

Of the rolling process, I presume if Mr. Pyke could have stepped into the rolling apartments of some of our sole-leather tanners, and have seen a man, with his foot, bring a roller on to leather varying from a few pounds to a few thousand pounds pressure, with a vibratory motion of from 70 to 100 per minute, he would not have racked his brain in contriving his india rubber and rings.

Of the boot and shoe pegging and nailing—about 40 years ago there were a great many boots and shoes made with nails in New England. The manner was thus:—the common wooden last was taken, a slab was sawn off the bottom from one-quarter to one-half an inch in thickness—this slab was sent to the foundry, a casting made from it, which, of course, would exactly fit the last; it was easily secured to the wood, and answered for clinching the nails when driven through the soles and uppers. Here in this climate, where the feet are often placed to the fire, the nails become more heated than the leather, and sometimes the leather was burned. The nailing process was soon abandoned. Then was introduced the screw peg for which, I believe a patent was granted; the screws made of hickory wood, with a slight thread cut like an iron screw, were made some feet long and cut off by the workmen of suitable length to suit the work they were used for. They were found somewhat difficult to drive, and expensive, and were soon abandoned. The present peg employed, every person is familiar with, and as evidence of the enormous quantity used, one house in Boston informed me they had sold, within the year, 3,000 bushels.

Probably Mr. Pyke may not think it for his interest to take out patents for his improvements in this country. H. Halsey.

Windsor, Ct., 1851.

Recent Foreign Inventions.

Incrustation of Boilers.—Mr. John Ashworth, of Bristol, recently obtained a patent for the following compound for preventing incrustations in steam boilers. The specification treats of the prevention of incrustation of steam boilers and generators, whether for marine or land purposes, by the introduction of a compound, which not only prevents any deposit, from the water becoming incrusted on the bottom of the boiler, but which also causes any deposit that may have adhered thereto previously, to become detached from the boiler-plate. In marine-boilers, the deposits principally consist of sulphate of magnesium and chlorate of sodium, while lime or other soluble earth form the deposit in boilers when fresh-water is employed. Incrustation is prevented by a compound of materials, consisting of coal-tar, linseed-water, plumbago or black-lead, and Castile or other soap, which is prepared and combined in the following proportions:—To thirty-two gallons of coal-tar add twenty-one gallons of linseed-water, which having been well mixed, five pounds of plumbago, or common black-lead, in a pulverized state, are to be added, and eight pounds of Castile soap. Although the patentee prefers Castile soap, common black soap may be used in lieu of it. These ingredients are to be mixed intimately together, so that the mass may be thoroughly incorporated, and will be of a creamy consistency, and then at once fit for use. This mixture is to be introduced into the boiler, after blowing off the steam in the proportion of about one gallon of the compound to a thirty-horse boiler, repeating it every three or four days, according to the nature of the water used in the boiler. If a great quantity of deposit results from the water used, the effect of the mixture will be attended with advantage by slightly increasing the quantity, or by repeating the dose at shorter intervals. The mixture may be introduced through the man-hole, although, to save trouble, a suitable apparatus may readily be adapted for the purpose, by simply opening a tap. Any incrustation that has hitherto accumulated, by the use of this mixture will become so loosened that it may readily be swept off from the boiler-plate, and removed, which will also be the case with any deposit that may afterwards take place in the boiler, these matters preventing its adhering to the metal, or even accumulating in solid masses, detached from the boiler. The linseed-water before-mentioned is prepared by boiling fourteen pounds of linseed by means of steam-heat, and afterwards straining and removing the seed and extraneous matter from the water.

Gas for Illumination.—Thomas G. Barlow and Samuel Gore, engineers, London, lately took out a patent for the following improvements in making gas:—

The patentees describe an arrangement of three retorts, &c., adapted for the purposes of their invention, in operating with which the retorts are, in the first instance, all charged with cannel or other rich bituminous coal, and the charges are worked off in the usual manner. The charge of the first retort is then withdrawn, and it is recharged with coal. The other retorts are not recharged, but the residue of the first distillation is left in them. Steam is now allowed to enter the third retort, where it will be decomposed by the incandescent coke, and converted into hydrogen, carbonic oxide, and carbonic acid gases, which, with any excess of steam, are conducted into the second retort. The excess of steam will, however, be condensed in its passage, and the gases will pass through the coke in the second retort, where the carbonic acid will become converted into carbonic oxide. The removal of the undecomposed steam in this manner is important, as it permits of the conversion of the carbonic acid into carbonic oxide in the second retort, which is not easily effected when an excess of steam is present. The gas passes from the second retort into the first retort, where it mingle with the rich gas from the fresh charge of coal, at the same time becoming itself carburetted by the bituminous products of the distillation of the coal. The whole of the gas then passes into the hydraulic main.

When the charge in the first retort is worked off, it is not withdrawn, but left in the retort, and the charge in the third retort is withdrawn, and it is recharged with coal. The steam is then allowed to enter the second retort, where it will be partially decomposed, and will then pass through the pipes and valves, where the excess of steam will be condensed, and the remaining gases will then pass over the coke remaining in the first retort as the residue of the first operation. The carbonic acid gas will thus be converted into carbonic oxide, and the mixture of carbonic oxide and hydrogen thus obtained will pass into the third retort, where it will unite with the hydro-carbons resulting from the decomposition of the fresh charge of coal, and the whole of the gas will pass into the hydraulic main.

In like manner, when the charge in the third retort is exhausted, it is not withdrawn, but allowed to remain in the retort, and the second retort is then emptied, and recharged with coal. The steam is then allowed to enter the first retort, where it is partially decomposed, and the excess of steam is condensed in its passage through the pipes and valves, and the gases will then enter the third retort, and unite with the gases and other products given off from the new charge of coal. The whole of the gas will then pass off into the hydraulic main. When the charge in the second retort is worked off, the first retort is emptied and recharged, as already described, and the operations thus follow one another in continual succcession.

In this mode of operating, the residue from each charge in place of being immediately withdrawn and replaced by a fresh charge, is retained in the retort, and employed in the production of gases of small illuminating power, for mixing with the richer given off from the fresh charge which is introduced into another retort. This mode of treatment is applicable to ordinary coal, especially the richer or more bituminous sorts, cannel coal, bituminous shales or schists, asphaltes, lignites, resinous earths, and other similar substances or mixtures of the same. In place of employing three retorts, as above described, two may be employed, and in that case each retort is emptied and recharged when the charge in the other retort is worked off.

Another mode of conducting the process consists in employing a single retort, each half of the length of which is charged alternately, when the charge in the other half is exhausted, and the steam is always admitted at the end containing the exhausted charge, and the gases allowed to pass off to the hydraulic main from the opposite end of the retort. The steam is thus decomposed by the exhausted charge, and the resulting gases unite with those evolved from the fresh charge.

In place of employing a long retort, and charging it alternately at each end, a shorter retort, furnished with a partition or diaphragm, may be used, and each compartment may then be charged alternately, when the charge in the other compartment is exhausted.

A Small Great Spy Glass.

We see it stated in some foreign papers, that a spy glass has been exhibited in London of no greater diameter than a wallnut, yet so powerful that the lineaments of a person's face can be read by it at the distance of a mile and a half. It weighs only one and a half ounces, and can easily be carried in the pocket of a gentleman's vest. We hope some of our opticians will go to work and construct like telescopes, so that we may have the pleasure of carrying such a handy instrument continually about our person.