Science Notes.

Electrolysis of Glass.—A very curious experiment upon the action of currents traversing glass has recently been made by Mr. Stansfield. He placed amalgams of potassium, sodium, and lithium in a balloon and immersed the latter in a bath of mercury kept at a temperature of 200°. The anode of a powerful electric battery was introduced into the balloon, while the cathode dipped in the external mercury. At the end of a few hours, the balloon was taken from the mercury, when the following phenomena were observed: With the amalgam of lithium, the glass had become very fragile and had lost a little of its transparency. The bath of mercury contained sodium.

With the sodium the same phenomenon, but the glass had undergone no alteration.

With the potassium there had been no transfer of metal.

Mr. Roberts-Austen attributes these singular results to the size of the atoms. According to him, the potassium, having too large a molecule, cannot substitute itself for the sodium in the glass for want of space. The lithium, having too small a molecule, replaces the sodium, but separates the constituent molecules and thus diminishes the cohesion. As for the sodium transported by the current, that substitutes itself in the glass for the silicate base without any other modification than a continuous carriage.

Building Materials of Wood Fiber.—According to the Schweizerische Bauzeitung, an inventor has just patented in Switzerland and other countries a new process for the manufacture of objects from wood fiber, such as paving blocks, building materials, etc. The wood fiber is mixed with a suitable agglomerant having mortar as a base. Previous to this, the fiber is impregnated with vitriol, sublimate, etc., to render it antiseptic, after which it is thoroughly dried. The plastic mass obtained through the mixture of wood fiber and mortar is well pulverized and pressed into moulds. As soon as the material has set it is removed from the mould and dried. It is said that the objects thus obtained are light, porous, and tough, and are bad conductors of sound and heat. They can be sawed, nailed, drilled, and otherwise treated, just like wood.

Solder for Glass.—According to the Revue Universelle, an alloy formed of 95 parts of tin and 5 of copper adheres to glass with such tenacity that it may be employed as a solder for connecting tubes end to end. It is obtained by first melting the tin and then adding the copper, the mixture being stirred all the while with a wooden rod. This mixture is run into a mould and melted anew when needed for use. The addition to it of from ½ to 1 per cent of zinc or lead renders it more or less hard.

Artificial Rubber.—According to the Revue de Chimie Industrielle, an artificial rubber of more or less strength may be obtained by dissolving 4 parts of nitrocellulose in 7 parts of bromo-nitro-toluol. Upon varying the proportion of the nitro-cellulose there may be obtained a material possessing elastic properties and much resembling India rubber, and even gutta percha. The bromo-nitro-toluol, says the Revue, may be replaced by nitrocumol and its homologues.

Preservation of Polished Surfaces against Rust.—L'Energie Electrique says that the polished surfaces of steel tools, such as chisels, saw blades, etc., may easily be preserved against rust by the following process. Half an ounce of camphor is dissolved in a quart of melted lard, and the scum which rises and floats on the surface is collected and mixed with sufficient graphite to give it the color of iron. The tools, having first been wiped, are covered with this mixture. At the end of twenty-four hours they are wiped with a soft rag. Thus treated, the tools will remain free from the least spot of rust for several months.

New Process for Hardening Glass.—Since the failure of the Bastie method of tempering and hardening glass, various other processes have been tried which have given more or less satisfactory results. Among these there is one, says the Revue de Chimie Industrielle, which originated in France, and consists in melting hard glass. The crude material, after having been melted in a peculiar style of crucible furnace, is run into moulds, as in casting iron, with the difference that instead of sand there is employed a special substance, and that the mould and the glass are heated and cooled at the same time. To replace the sand a material is selected that has the same conductivity and the same calorific capacity as glass. In this way the glass and the mould form, as it were, a homogeneous mass and the glass can be cooled without crackles, even though the cooling should be effected with relative slowness, this being indispensable whenever it is desired to obtain a hard glass. If care be taken that the surface of the glass do not approach the external envelope of the mould, it makes little difference in what manner the cooling is afterward effected, since the main point is that the mould and the glass shall be brought to the same high temperature, which must be rather greater than that at which glass hardened in a press is usually produced. After the mould has been perfectly heated, it is removed from the furnace and left in the open air, the effect of which is generally rapid enough to produce a proper hardening of the glass. After the whole has become well cooled the mould is opened and the piece removed.

Liquid Cement for Porcelain.—An excellent cement for china and porcelain, says the Revue Scientifique, may be obtained by melting together 75 grains of fish glue and 5 drachms of crystallized acetic acid, and afterward heating the solution until it becomes of a sirupy consistence, so as to form a jelly upon cooling. To use it, the jelly is placed upon a stove, so as to bring it to a liquid state, after which the edges of the broken crockery are coated with it and the pieces strongly compressed.

AN IMPROVED GRAIN BIN.

The illustration represents a bin which may be readily changed from a ventilated bin for ear corn to an inclosed bin for shelled corn, wheat and other grain, protecting the ear corn from the weather and thoroughly drying it by currents of air, and the change being quickly made to adapt the bin for the two uses. The improvement has been patented by Mr. Samuel E. Kurtz, of Mansfield, Ill. The sides and ends of the bin are preferably boarded with drop siding to render them weatherproof, and ventilators are formed in the bin by nailing slats or cribbing on a portion of the side and end studdings, whereby a series of flues is formed at certain distances along the sides and ends of the structure. When further ventilation is desired, or when middle studding is required, as may be necessary in an elevator building or a structure of several stories in height, some of the central studdings are similarly connected in pairs by means of slats, the ventilating flues thus formed each communicating with an opening in the floor, thus permitting a free circulation of air throughout the interior of the largest storage space. When the bin is to be used for shelled corn, oats, wheat, etc., the bottoms of the

KURTZ'S GRAIN BIN.

ventilators are closed by short pieces of boards, the grain then filling the ventilators, or, if desired, wire gauze may be fastened over the slats of the ventilators, whose bottoms may then be left open, and a good circulation of air thus insured through the shelled corn and grain. It is claimed that a storage bin of this construction will last as long as a residence, and may be used with advantage as a shelter or for other purposes when not occupied for storage.

Perfumes—Natural and Artificial.

Almost all the natural perfumes are of vegetable origin, and are derived from treatment of flowers and fruits. In this way are obtained the aromatic essential oils of rose, mint, anise, santal, thyme, cloves, etc., and the perfumes of the violet, iris, and jasmin. Musk is the only important perfume that is of animal origin.

For a long time now, however, the odor of fruits has been imitated with the aldehydes and ethers of fatty acids, such as the acetates, valerianates, benzoates, salicylates, and butyrates of methyl, ethyl, and amyl, which, mixed in definite proportions, recall the odor of strawberries, apples, pears, etc. The following are two examples of such mixtures:

PERFUME OF THE PINEAPPLE.

Chloroform	10	grains.
Aldehyde	10	"
Butyrate of ethyl	50	"
Butyrate of amyl	100	"
Glycerine	30	"
Alcohol, 100 per cent (liter)	1	

PERFUME OF THE APPLE.

Chloroform	10	grains.
Nitric ether	10	"
Aldehyde	20	"
Acetate of ethyl	10	"
Valerianate of amyl	100	"
Glycerine	40	"
Alcohol, 100 per cent (liter)	1	

The aroma of rum and cognac and the bouquet of wines have also been reproduced artificially. We shall not dwell upon the danger that accompanies the use of these products in a large quantity when they are mixed with beverages and alimentary substances.

Professor Lowe's Experiences with Balloons.

Professor T. S. C. Lowe, whose successes at Pasadena, Cal., in opening the wonders of Mt. Lowe are now well known, contributes an interesting paper in a recent number of the Mt. Lowe Echo, in which he gives some of his early balloon experiences. We make the following extracts:

The significance I attached to my early balloon work can be better understood if my reader compares and considers it with the "kite flying" of Benjamin Franklin. So much does the modern scientific world think of Benjamin Franklin and his simple kite, that one of the most imposing statues of the World's Columbian Exposition represented him in the act of flying the kite, and it occupied the post of honor at the main entrance of the Electrical building. It seemed a small and insignificant affair, and yet it was that "kite flying folly" that led to the discoveries which have made possible the telegraph, submarine cables, telephone, phonograph, electric lights, electric railways, and the thousand and one scientific and useful instruments and appliances of modern electricity. All these wonderful and useful inventions are the indirect result of that one little experiment of Franklin's, thus demonstrating the value of even small things, when directed for a scientific purpose by a scientific mind.

Few people understand the deep scientific interest that was felt by Joseph Henry and many men of his intellectual stamp in my balloon trip from Cincinnati in April of 1861. The trip was made purely in the interests of science. There was no monetary or other inducement in connection with it. In my observations of air currents I had become absolutely convinced of the existence, in the higher atmosphere, of a current which uniformly and almost invariably moved eastward, with but slight variations, no matter how diverse the surface currents might be. In order to test the existence of this current, over the ocean as well as the land, I planned the exact and necessary machinery to carry on the work, and the trial of it so interested a number of the prominent Eastern bankers and merchants that they offered to help sustain the expense, with a view—provided it was shown to be perfectly safe—to the inauguration of a balloon system which would convey information across the Atlantic in much less time than that occupied by the mail steamers. In those days there was no telegraphic communication between the United States and Europe, the first Atlantic cable having failed, and the only way, therefore, of getting mercantile news across the ocean was by means of the steamers. The merchants knew that the reduction by a day, or even, sometimes, of but two or three hours, in the time of the receipt of important news on business or other affairs would often make a difference to them of many thousands of dollars, enabling them to dispose of, or buy up, goods ahead of their competitors. This was the secret of their willingness to aid in sustaining the expenses of my earlier experiments. I was ready to receive their help, but my object in the work was purely for the interests of science, and to further the organization of the Weather Bureau elsewhere spoken of, and which has since been accomplished on the lines I suggested, by the United States government.

I had already constructed the aerostat for my Atlantic journey. It was the largest one ever built and has never since been approached in size or equipment. With it I safely lifted from the earth, including its own weight, sixteen tons, so that I was thoroughly convinced that I could safely convey across the Atlantic all the materials I required for comfort and safety. Not only was this balloon to carry ample instruments, provisions for the crew, and all the implements, etc., required for observation, and the manipulation of the balloon, but also a full rigged lifeboat schooner with airtight compartments, built of light steel plates.

Chambers's and other encyclopedias state that this balloon would lift 22½ tons. In order that the reader may not misunderstand the apparent discrepancies between their statements and mine given above, permit me to explain that had the balloon been filled with pure hydrogen gas, it would have lifted 22½ tons, but on this occasion I had to use the ordinary coal gas, which, being heavier, permitted me to lift only 16 tons.

Professor Henry, however, was so adverse to my running any risk by making the trip over and across the Atlantic, that he suggested before doing so I should thoroughly test the existence of this current over a long land distance. He advised me to go west with my balloon, make an ascent when the earth currents were blowing strongly to the west, and then, if when reaching the upper currents I sailed across the continent east, the existence of this eastward current, which I claimed did exist, would be sufficiently demonstrated to justify his urging the government to aid me in continuing the experiments, with a view to the organization of the Weather Bureau, to which object I had devoted my attention for so many years.

Acceding to Professor Henry's request, I left my large balloon, and, taking my smaller experimental balloon, went to Cincinnati, and for about a month waited for conditions to be exactly as I desired before making the ascent. The newspapers took a great deal of interest in the project, some of them speaking in the most favorable terms of the work. At last the conditions were highly favorable for the experiment, the surface currents moving rapidly westward, and, accordingly, after learning by telegraph that the same conditions existed as far east as Washington, I made the ascent at about 3:30 o'clock of the morning of April 20, 1861. It was fully midnight before I was satisfied as to the existence of these westward-blowing earth currents extending from the Atlantic to Cincinnati, and then, having arranged with the superintendent of the city gas works for the inflation of the balloon, I proceeded at once to direct that important and necessary work.

My readers must here understand that gas, exactly the same as atmosphere, absorbs and holds in suspension in warm weather more moisture than it does when it is cold, so that, the day having been warm and murky, the gas with which the balloon was inflated on this occasion held its full proportion of moisture in suspension.

In ascending I started rapidly toward the west, as the surface currents from the east were quite strong, When I reached an altitude of 7,000 feet I struck the eastward-flowing current, and here very rapidly the thermometer went down to zero. This sudden cold congealed the moisture held in the gas, and formed a fine, glassy, bead-like hail, which in the absolute stillness I could distinctly hear falling upon the silk and rolling down into the neck of the balloon. It being night, it was impossible for me to see it, but under similar circumstances in the daytime, I have seen a miniature snow storm going on inside the balloon when I have left a warm for a cold current of air. It was not a soft snow this time, but, no doubt, owing to the rapid change into so great a difference of temperature, it was a hard, bead-like hail. When the valve was opened to let the expanding gas escape, a bushel or more of this fine hail was discharged.

This caused the balloon to ascend still higher, until, by looking toward a star over the top of the mercury column in the barometer, through a slot I had had arranged for that purpose, and feeling the raised figures—for it was dark and I had made no arrangements for lighting—I found that the balloon was at an elevation of 14,000 feet.

This altitude it retained until sunrise, when the heat of the sun expanded the gas still further, and it rose to the altitude of 18,000 feet.

And such a sunrise!

The horizon appeared always on a level, so that the earth resembled a great hollow bowl, with the exception of the Blue Ridge Mountains, which, owing to their great distance, fully 200 miles, resembled a solitary peak arising from the ocean.

As sunrise approached, the streaks of light rapidly running around the horizon resembled bands of molten gold, and when the sun itself appeared, I was never more astonished and surprised. It was entirely different from our everyday luminary. There was a total absence of its usual dazzling appearance. It resembled a disk of burnished copper, as such a disk would appear when not in the bright rays of any powerful light. This singular appearance was retained during the time of the entire voyage, so long as I remained at an elevation of from 16,000 to 18,000 feet.

This fact proved to me that the dazzling appearance of our great luminary is caused by our atmosphere and the elements it contains, or holds in suspension, within three or four miles of the earth.

The sky, too, was inexpressibly beautiful, even during the daytime, resembling a rich, dark-blue velvet, and the sun, moon and many of the stars were all visible at the same time.

To return now to the point of departure. Mr. Potter, proprietor of the Cincinnati Commercial, and Murat Halsted, the editor, arranged to be with me at the time I decided to make the ascent. They brought down a number of delicacies of all kinds for me to take along, and Mr. Halsted thoughtfully provided me with a large jug of hot coffee, which he wrapped up in a number of blankets in order to keep it hot, which it did throughout the entire journey. He also brought me 200 copies of the Cincinnati Commercial announcing the preparations that had been made for this trip, that the balloon was now being inflated, and that "shortly after going to press Professor Lowe will have left the earth for the purpose of making his long anticipated aerial eastern voyage."

Some of the newspapers amusingly stated after I had ascended that the balloon which had gone up for the purpose of demonstrating the existence of an upper air current which invariably flowed eastward, when last seen, was rapidly sailing west. But when later in the morning at daylight telegraphic dispatches were sent all over the country from Falmouth and Lexington, Ky., saying that a large balloon had been seen rapidly moving eastward, all who saw the dispatches and knew of my discovery were convinced of the correctness of my former deductions.

The average height at which I sailed was about 16,000 feet, but in crossing over the Alleghanies I demonstrated that air currents bound and rebound exactly as the currents of water do. The air was flowing rapidly eastward and as it struck the crests of the Alleghanies it flew up and on, making a great upward curve, into which, of course, my balloon was forced. In a few moments I ascended to a height of 22,000 feet, probably 6,000 feet higher than the balloon could have gone by its own lifting power, and when it made the curve on the other side of the range, I descended so rapidly that the fall was over a mile in less than a minute. Though racing through space with such extreme rapidity, everything around me was perfectly quiet and still—so still, that I could have carried a lighted candle without any protection, and I left loose sheets of paper about without any fear of their being disturbed. The reason for this may not be quite clear to all my readers. I was floating with, as well as in, the undisturbed atmosphere; consequently, there was not the slightest sense of motion whatever. The altimeter, my instrument for measuring latitude and longitude, and thus determining the rate at which I was traveling, showed such a rapid movement of the balloon to the east that I doubted its accuracy, until I glanced down over a rope hanging for 100 feet below the car, and there noticed the short space of time it required to cross large farms, fields, woods, etc. The velocity was so amazing, that I no longer doubted the accuracy of the registrations of my altimeter.

Before reaching the Alleghanies, owing to the flow of a deep and rapid current of air between that range and the Blue Ridge, my balloon was drawn slightly southward, out of the direct eastern path, and I finally landed in South Carolina, a short distance from the line of North Carolina, nearly in a due east direction from Cincinnati.

In crossing Virginia I distinctly heard the cannonading with which the Virginians were celebrating their secession. South Carolina had already gone out of the Union, and the descending of my balloon caused much excitement. It being only eight days after the attack on Fort Sumter, I was considered a Federal spy, arrested and locked up in Columbia jail. Indeed, it was asserted on good authority that I was the first prisoner of war captured by the South during the civil war. Not desiring to be shot as a spy, I sent for the president of the South Carolina College, who explained to the authorities that he was familiar with the purpose of my balloon experiments, which at that time had nothing to do with the army, and at his solicitation I was released. Mayor Boatright, of Columbia, gave me the freedom of the city and a letter bearing the city's seal, asking a safe conduct for me through the Confederate States of North America. As I passed through Tennessee I learned in a peculiar and interesting way that the State had gone out of the Union in secret session. This I communicated to President Lincoln two weeks before it became authentically known in the State.

BALLOON ARMY SERVICE.

Returning to Cincinnati and desirous of accomplishing my Atlantic trip, I was surprised and disappointed to receive a dispatch saying that President Lincoln desired to consult with me in regard to organizing a balloon service for the United States army. Failing to get assistance for my Atlantic enterprise, owing to the unsettled condition of the country, and urged that my own personal desires should be subservient to the wishes of the government, I went to Washington, consulted with the President and military authorities, with the result that the aeronautic corps of the United States army was organized. Just here old methods were found too slow, clumsy and absolutely impracticable for army service. Necessity became the mother of invention, and new devices were quickly developed which have never since been improved upon. Thus the balloon corps began its work, and for the first year of the war was constantly operated on the Potomac, Chesapeake Bay and the James, York and Pamunki Rivers, the balloon being manipulated by means of a barge towed by a tug and guarded by a gunboat.

The balloons were of great service at Yorktown and in all the battles which followed up to the time of Fair Oaks. I am usually asked: "Did the enemy ever fire at the balloon?" I reply: "That was almost a daily occurrence, but having early acquired a fair knowledge of artillery practice, and understanding the calculations that had to be made before so unsteady a mark could possibly be hit, I was enabled, by hiding the base of the balloon operations behind trees or hills, to conceal my distance so that aim could not accurately be made by the gunner." I am often asked if the Confederates used balloons. I would state that they had one in use for a few hours at the commencement of our seven days' battle. Having no aeronauts of experience, they were compelled to inflate it in Richmond and tow it to the scene of action. While it never ascended more than 400 feet, I understand it served them to good purpose while in use. It was afterward stowed away on the Confederate gunboat Teaser, which we captured. The balloon was turned over to me; but finding it of poor material and useless for aeronautic purposes, I cut it up, giving each member of Congress a piece. Their aeronaut evidently thought nothing but silk would answer his purpose, but good cotton would have been much better than the silk they used. Having none of the requisite quality, a convention of ladies was held in Petersburg, of whom 200 each gave a silk dress toward building the balloon. Thinking this might be of special interest, I show you a piece of this historic construction, which, you will observe, represents four patterns of silk dresses.

Thick Fires.

It is the prevailing opinion with some that it is necessary when a boiler is worked to a high rate of capacity to maintain correspondingly heavy fires. It is argued that thin fires are well enough for slow rates of combustion, but as the call for steam increases it must be met by an increased thickness in the bed of coal on the grate. Where heavy fires are carried it is a common thing for the fireman to shovel in all the coal that he can conveniently supply, going so far as to almost fill the opening at the fire door, leaving little if any room for a future supply until that already in has been pushed back to make room for more. The ordinary fireman is apt to favor this method, for the reason that he can introduce large quantities at a firing, and afterward he is not obliged to give the fires much attention for perhaps an hour's time, when he will again fill the furnace full in the same manner as before. This method of firing with most of the high-class bituminous coals in use in the Eastern States requires from time to time the use of the slice bar for breaking up the bed of coal. It has always seemed to the writer that whatever necessity there may be according to the popular idea for carrying heavy fires, in the matter of the amount of labor involved it is in reality more laborious for the fireman than it would be if the fires are kept comparatively thin and small quantities of coal supplied at each firing. As an explanation, however, of the favor which this method receives, it is probable that the class of labor which is generally employed considers the muscular effort required much less of a task than the more frequent and careful attention which is needed when the fires are kept at medium thickness.

As regards a comparison between thick and thin fires, the fact is that more capacity can be obtained from a boiler when a fire of medium thickness is carried and proper attention is given to its condition than can be realized by any system of management when the fires are exceedingly heavy, and advocates of thick fires, who take the ground that they are a necessity when boilers are forced, are entirely mistaken. As to the economy of the two, some persons maintain that heavy fires give the most economical results, but this is questionable. Valuable information on the subject has recently been brought out by the results of two evaporative tests, which we give below. They were made on a 72 inch return tubular boiler having 1,000 3½ inch tubes, 17 feet in length. The heating surface amounted to 1,642 square feet and the grate surface to 36 square feet, the ratio of the two being 45·6 to 1. On the thick fire test the depth of the coal on the grate varied from 8 to 20 inches, being heaviest at the rear end and lightest at the front end. On the thin fire test the depth was maintained uniformly at about 6 inches. The coal was New River semi-bituminous coal. The difference in the results as appears from the figures is an increased evaporation due to thin fires amounting to 15·6 per cent.

Conditions as to thickness of fires.	Thick fires.	Thin fires.
1. Average boiler pressure, pounds...... ..	131·6	130·4
2. Average temperature feedwater, degrees.	39·6	43·5
3. Average temperature flue gases, degrees.	484	487
4. Average draught suction, inches........	0·17	0·18
5. Per cent moisture steam, per cent......	0·25	....
6. Coal per hour per square feet grate, pounds	13·72	12
7. Per cent ashes, clinkers, per cent........	5·1	5·7
8. Horse power developed on basis 30 pounds from 100 at 70, horse power.	140·3	144·4
9. Water evaporation per pound coal, pounds..........	8·517	9 457
10. Equivalent evaporation, per pound of combustible from and at 212 degrees, pounds............	10·985	12·234

The Products of Salt Electrolysis.

Some improvements relating to the methods of dealing with the products set free in the electrolysis of salt solutions have been devised by the Compagnie Electro-Chimique de St. Beson. The chlorine and the soda solution being brought together outside the electrolytic apparatus, are employed in the manufacture of hypochlorite of sodium, or else the chlorine being given off is converted into various useful derivatives, while the caustic soda is dealt with separately. In the latter case the soda is mixed with litharge in a digester, mechanically agitated and heated; the hot solution is then carbonated, with the result that insoluble white lead is precipitated, and afterward separated off by means of a filter press. The alkaline liquid is further carbonated for the production of insoluble bicarbonate in solution of sodium chloride, the mother liquor being afterward returned to the electrolyzer.