How Aluminum is Obtained.

A mixture of ground aluminous clay (ordinary clay, but of a good quality) and soda ash (carbonate of sodium) are heated in a furnace, aluminate of soda and silico-aluminate of soda being formed. The fused mass is then broken into pieces and thrown into an iron tank containing water; the mass is frequently stirred, and finally allowed to settle.

The aluminate of soda (being soluble in water) is dissolved, while the silico-aluminate of soda (being insoluble in water) sinks to the bottom of the tank, with any peroxide of iron that may be present in the clay.

The liquid is then drawn off, and carbonic acid gas passed through the solution. This decomposes the aluminate of soda, forming carbonate of soda and pure alumina hydrate. Thus:

$$\underbrace{2AlNaO_2}_{\text{Aluminate of Soda.}} + \underbrace{CO_2}_{\text{Carbonic Acid Gas.}} + \underbrace{3H_2O}_{\text{Water.}} = \underbrace{Na_2CO_3}_{\text{Carbonate of Soda.}} + \underbrace{2Al(OH)_3}_{\text{Alumina Hydrate.}}$$

The alumina hydrate is then dried, mixed with chloride of sodium (common salt), and charcoal or coke, and formed into balls about the size of an orange. These balls are then taken and put into a vertical earthen retort and heated to redness; then a stream of chlorine gas is passed through them. The chlorine combines with the alumina (being greatly helped by the charcoal), and forms chloride of aluminum, which unites with the sodium chloride (common salt), and distills over or sublimes as double chloride of aluminum and sodium, thus:

$$\underbrace{Al_2O_3}_{\text{Alumina.}} + \underbrace{2NaCl}_{\text{Common Salt.}} + \underbrace{3C}_{\text{Coke.}} + \underbrace{3Cl_2}_{\text{Chlorine.}} = \underbrace{3CO}_{\text{Carbonic Oxide Gas.}} + \underbrace{2AlNaCl_4}_{\text{Double Chloride of Aluminum and Sodium.}}$$

Ten parts of the double chloride of aluminum and sodium thus formed is mixed with five parts of kryolite (a double fluoride of aluminum and sodium, found in Greenland), which serve as a flux, both in a state of fine powder, and to this mixture is added two parts of (metallic) sodium in small pieces.

The whole is now introduced on to the hearth of a reverberatory furnace, previously heated to the required degree, when a violent reaction ensues. The dampers are then closed, and all parts of the furnace kept as close as possible, to prevent access of air. This causes the mass to completely fuse. When the action has subsided and the decomposition is completed the furnace is tapped and the metal and slag are run into suitable moulds. Most of the aluminum collects in the bottom of the mould. Above this are two layers of slag, the top layer being sodium chloride (common salt), the middle layer being less fusible than the top, and consisting chiefly of fluoride of aluminum, in which small globules of aluminum are mechanically held, which are recovered by pulverization and sifting of the slag.

The following equation will show the reaction that takes place in the above reduction. Thus:

$$\underbrace{AlNaCl_4}_{\substack{\text{Double Chloride of Aluminum and Sodium.}}} + \underbrace{AlNaF_3}_{\substack{\text{Kryolite, or Cryolite.}}} + \underbrace{6Na}_{\text{Sodium.}} = \underbrace{2Al}_{\text{Aluminum.}} + \underbrace{4NaCl}_{\text{Common Salt.}} + \underbrace{4NaF}_{\substack{\text{Fluoride of Aluminum.}}}$$

There are other methods, but this, says Mr. G. W. Gray, in *Knowledge*, gives the purest metal, and is one generally used in England and France. Messrs. J. Lowthian Bell & Co. (or Messrs. Bell Bros.), at Washington, near Newcastle-on-Tyne, manufactured aluminum on a large scale for several years, but gave it up a few years since, owing to it not paying so well as was first anticipated, and also on account of the limited demand for the metal. I think they used the above method.

Glucose from Cassava.

For some time past rumors have been current here of a company being in process of formation with a view of manufacturing glucose from cassava, but after careful inquiry, we have not been able to trace them to a reliable source. We have no hesitation, however, says the *Confectioners' Journal*, in saying that such a company is contemplated at an early day, and this fact adds interest to the plant which seems destined to take a prominent part in the development of the confectionery trade, and calls for more than a passing notice from us as to the nature of cassava, its *habitat* and its merits as a saccharine producing material. All confectioners know that glucose has become a very important article of commerce during the past few years, and the consumption of it has reached 200,000 tons in this country alone, and a large quantity is annually exported. It has been made heretofore from corn, which has advanced so much this year as to make this much-needed article quite expensive. The demand for it is very large and exceeds the supply. Heretofore the profits of manufacturing it have been very great at the rate paid for corn during the past few years. During the trial of a recent lawsuit in New York it came out in the evidence that the Buffalo Grape Sugar Company sold to one agency $100,000 worth of grape sugar, or glucose, per month. That company is now using nearly 6,000 bushels of corn every day in the week. A bushel of corn weighing fifty-six pounds will yield thirty pounds of sugar or glucose; the average net profit on a bushel of corn is between forty and fifty cents, since when the price has materially advanced. This would make the average profits of the Buffalo Grape Sugar Company over $1,000,000 a year, on a capital now invested of $4,000,000. The manufactured glucose is used chiefly for making table sirups, candies, for brewing purposes, as food for bees, and making artificial honey. It is estimated that 11,000,000 bushels of corn will be used this year by the various manufactories of this product in this country. The average production of corn in the States of Pennsylvania, New York, Ohio, Michigan, and Illinois is 35 bushels to the acre. The amount of glucose produced from one bushel is 30 pounds, or 1,050 pounds to the acre. Well authenticated evidence is at hand to the effect that 20 tons of cassava to the acre is no unusual crop in Florida. This would, at 56 pounds to the bushel, give a yield of over 700 bushels per acre, and, at the rate of 30 pounds of glucose per bushel, would produce over 21,000 pounds of glucose per acre. A comparison of the yield of glucose from corn and cassava from a large area is as follows: 1,000 acres of corn yields about 500 tons of glucose; 1,000 acres of cassava yields about 10,000 tons of glucose.

The method of cultivation is generally as follows: The ground is prepared as for planting corn, the seed (which consists of a section of the stalk containing an eye) is set in the sandy soil spaced about two feet, in rows three feet apart. When about eighteen inches high the field is cultivated in order to raise the soil about the base of the stalk, which affords a better support to the plant.

The leaves of the branching top shade the ground, and prevent the formation of weeds and evaporation of surface moisture. No irrigation is required, as the moisture is continually supplied to the tubers by capillary attraction. The tubers grow somewhat similar to the sweet potato, radiating from the base of the plant and lying generally horizontal. They may be utilized in about six months after planting, and will continue to grow without deterioration for a period of two years or upward, developing to such an extent that tubers weighing from sixty to eighty pounds have frequently been taken from the soil. The harvesting of the crop is very simple: The stalk is raised and tubers extracted by simply pulling them from the loose soil. The plant maybe again inserted, when it will produce new roots. The earth in this case is the storehouse from which the supply is extracted as required, with the advantage of the crop increasing in value as long as it remains therein, whereas in corn there is a season for harvesting, storing, handling, and rehandling before it comes to the hands of the manufacturer.

Cassava may be removed from the ground any day in the 365, and carried to the mill for direct treatment. For many years the root has been raised in Florida and used for many purposes. The plants are natives of South America. The roots (tubers) may be preserved for food purposes, by being simply cleaned, sliced, and dried; from such dried slices manioc or cassava meal, used for cassava bread, etc., is prepared by simply grating. The starch is separated and prepared for food under the name of Brazilian arrow-root, and this, when agglomerated together into pellets on hot plates, forms the tapioca of commerce.

The glucose made from cassava is of fine body and flavor.

NEW INVENTIONS.

An improved cuff or collar fastening has been patented by Mr. Mahlon Loomis, of Lynchburg, Va. This invention consists in a strip of metal bent at each end in opposite directions to form spring hooks, having the inner surfaces roughened or serrated and the curved portions corrugated.

An improved nose feed bag for animals has been patented by Mr. Charles J. Gustaveson, of Salt Lake City, Utah Ter. This nose bag has a supporter having two or more cross stays on the lower end for protecting the perforated bottom. The latter is made removable so that the device may be used as a muzzle.

An improved horse collar pad has been patented by Mr. Friderick F. Kanne, of Waterville, Minn. This improved pad can readily be applied to or removed from a collar; only the lugs of the arched frame rest on the horse's neck, and they are covered by a double thickness of leather. The pad will adapt itself to the neck of any horse, and the collar cannot become misplaced in its seat in the curved frame. There is an air chamber for the free circulation of air between the curved arched frame and the pad.

An improvement in end gates for wagons has been patented by Mr. Stephen D. Davis, of Malvern, Iowa. This invention relates to end gates for wagons, which are adapted to be let down to form boards or extensions to facilitate the use of a shovel in the removal of corn, potatoes, etc., with which the wagon may be loaded.

An improvement in that method of closing bottles and jars in which the stopper is made in two parts with holes through both parts that are closed by bringing these two parts together, has been patented by Mr. James D. Foster, of London, Ky. It consists in combining with the neck of a jar two circular disks of equal diameter having flat sides with holes through them, which holes are arranged out of registration, and one of which disks is forced down flat upon the other to close the holes in the same and form practically but a single stopper, and with which two disks is preferably combined a top coating of wax or cement.

Mr. Charles A. Kilpatrick, of Athens (Orcut Creek P. O.), Pa., has patented an improved adjustable instrument for planing and smoothing the edges of soles of boots and shoes. It consists in a handle with a bend or knee in the middle, and provided at this bend and on the under side with a curved knife and a gauge adjustable in the direction of the length of the handle. A sliding gauge, moving at right angles to the length of the handle, is held on the side of the same by a suitable screw.

An improved machine for spinning and reeling silk has been patented by Mr. Joseph E. Tynan, of Paterson, N. J. These improvements relate to machines for spinning and reeling silk. The usual process is to spin or twist two or more threads of unspun silk to form a single warp, which is afterward reeled into skeins by a separate machine. The object of the improvements is to perfect both the spinning and reeling mechanism, and further, to combine them in one machine, so that the operations can be successively performed without the time and labor required for spooling the silk after spinning.

An improved car coupling has been patented by Mr. Moses Robeson, of Galena, Kan. The object of this invention is to provide a car coupling by means of which two cars can be coupled together and uncoupled without running them together while the link is being adjusted, thereby avoiding danger to life and limb in coupling cars.

A New Sleep-Producing Agent.

According to the *Medical Record* Professor C. Binz, in a series of articles contributed to the *Berliner Klinische Wochenschrift*, announces the discovery of nerve-depressing and sleep-producing properties in ozone.

The accepted view regarding this gas has been that it is very easily decomposed, nascent oxygen being set free; that it is extremely irritating on this account to the tissues, acting much like chlorine, and that it cannot be absorbed by the blood. Binz, however, shows that, in proper quantities, it is not irritating, can be inhaled and absorbed, producing, as he claims, peculiar effects on the nervous system.

The gas was generated by the sparks of an electrical battery containing four of Bunsen's elements. The ozonized air was conducted by a tube through chloride of calcium. It was then carried by a tube either to a large air-tight glass bell, in which an animal was placed, or to a mask which was worn by the persons who inhaled it. Animals were first tried. If a strong and long-continued dose of the ozone was supplied, the usual symptoms of laryngeal and tracheal catarrh with strangulation and death occurred. If supplied in more diluted quantities for less than two hours, sleep or a lethargic condition was produced. Frogs, rabbits, and kittens, reacted best. The latter would, in the course of ten or fifteen minutes, become quiet and then lie down and apparently sleep. Shaking the jar would not arouse them. When removed and supplied with fresh air, however, they soon returned to their normal condition. Several animals were killed after having been in this condition, and no changes in the air passages or other tissues noted. Precautions were taken and experiments made to show that there was no carbonic acid poisoning and no introduction of nitrous oxide gas. The animals could, as a rule, be kept in the bell-jar for two hours before any symptoms of irritation appeared, even of the outer parts of the air passages.

The experiments were then tried upon human beings. Dr. Hugo Schultz was the first to submit himself. Subsequently five other gentlemen inhaled the gas. Three of them were put to sleep by it, the others were slightly stupefied or otherwise depressed. The time required for bringing on sleep varied between six and sixteen minutes. The sensations during this time were very agreeable. After removal of the gas the sleeper would awake within half a minute, generally sooner. It was suggested that in one quite susceptible person the condition was a hypnotic one, but inhalation in the same way of pure air produced no effect. After awaking there was some feeling of fatigue, but this soon passed away.

Large and prolonged doses of the gas produced sensations of nausea, dizziness, and strangling. But the diluted ozone was breathed for over half an hour without harm. Binz states that in too small amounts no effect is gotten; in too large ones, irritation is produced. He compares its action in this respect to that of alcohol when given. Prof. Binz claims no practical results from his discovery as it stands at present, but thinks that like every new scientific truth it may have eventually some useful bearing,

Coloring Metals.

Metallic objects may be colored by immersing them in a bath formed of 640 grains of lead acetate dissolved in 3,450 grains of water and warmed to from 38° to 90° Fah. This mixture gives a precipitate of lead in black flakes, and when the object is plunged into the bath the precipitate deposits on it. The color given depends on the thickness of the skin, and care should be taken to treat the object gradually, so as to get a uniform tint. Iron treated thus acquires a bluish aspect like steel; zinc, on the other hand, becomes brown. On using an equal quantity of sulphuric acid instead of lead acetate, and warming a little more than in the first case, common bronze may be colored red or green with a very durable skin. Imitations of marble are obtained by covering bronze objects, warmed to 100° Fah., with a solution of lead thickened with gum tragacanth, and afterward submitting them to the action of the above-mentioned precipitate of lead.

Do Bees Injure Grapes?

At the late annual meeting of the Northeastern Beekeepers' Association, the charge that bees injure grapes was discussed with some feeling. Two bills have been introduced in the California Legislature to forbid the keeping of bees because of the damage they are said to do to the ripening grapes. The northeastern beekeepers were unanimous in the opinion that honey bees never puncture the skin of the grape, though they frequent the vines to suck the juices of grapes already injured by birds or other insects. This it was claimed has been demonstrated by careful tests. Black ants are the chief mischief makers.