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SCIENTIFIC COMMISSION OF JAPAN.

There are two parts of the world now rapidly advancing to the front rank as centers of civilization, which fifty years since were practically unknown to the Caucasian race, namely, Australia and Japan. The former has been transformed from a savage wilderness to a state of comparative cultivation and wealth with a rapidity only paralleled on the continent of America. The latter, which for ages has remained in a state of barbarism, has at last shaken off, in a great measure, the prejudice and superstition that prevented its progress, and has shown that it has the material, power, and resolution to take its place with the most civilized nations of the earth. A few years will affect this wonderful transformation. The present generation may live to see it.

It is worthy of remark, that the most powerful influence in bringing about this great change in the condition of Japan is the outcome of American civilization. One of the oldest nations on earth now sits at the feet of the youngest, and asks for aid and instruction in all that pertains to the material interests of its people. Our engraving gives accurate portraits of the distinguished American citizens selected by the Japanese Government as a scientific commission to investigate and report upon the commercial industries and agricultural resources of the country, and to give counsel as to the best means of developing such resources.

The chief of the Commission is General Horace Capron, long and favorably known as a thoroughly scientific agriculturist, conversant as well with the various sciences collateral to agriculture, and late Commissioner of the United States Agricultural Department, in which difficult position he has won richly deserved commendation, from those qualified to judge, in all sections of the country.

Professor Thomas Antisell, of Washington, accompanies the party as an expert in the subjects of mining and manufactures. Professor Antisell's reputation as a technical chemist, mineralogist and geologist is well known, and General Capron is to be congratulated upon having secured his services.

The work of the Commission includes the examination of the country with reference to the introduction of railroads and other improved means of transportation. This branch is confided to Major A. G. Warfield, Jr., of Baltimore, Md. Major Warfield is looked upon in his profession as one of the most competent of its younger members; has already had much experience in the special class of work which is likely to be demanded in Japan, and is pronounced by no less an authority than Latrobe, of Baltimore, one of the best locating engineers of the country.

The Secretary of the Commission, Doctor Stuart Eldridge, of Washington, D. C., possesses high scientific and literary qualifications, and, although a young man, has achieved a prominent standing in his own profession.

The Commission is amply provided with the necessary equipments and instruments of precision; and, with such a *personnel*, there is much to be expected from its labors. We look confidently for a result which shall benefit not only our island neighbors, for neighbors they are both in interests and feeling, though so far distant in miles, but shall, perhaps, be of equal advantage to ourselvea. While Japan is represented by such men as Mr. Mori, the Minister at Washington, and Consul Charles Wolcott Brooks, of San Francisco, international commerce must increase, community of interests be more fully recognized, and the good feeling, already existing between the great nations of the East and West, strengthen and become permanent.

By late advices from Japan we learn that the Commissioners were received with high honors by the Japanese Government, on arrival at Yokohama and Yeddo. At the former place a grand salute was fired from the forts, and on their landing they were received by a delegation of Japanese officials of high rank. On the next day they embarked on a Japanese war steamer for Yeddo, being saluted by the fleet at that fort on passing, and were received on landing by another delegation of Japanese officials, among whom were the Prime Minister and Minister of Foreign Affairs. A grand banquet was given there by the Prime Minister and Cabinet at the Summer Garden on the 9th of September, which was followed by a number of others at the residences of the different members of the Cabinet. On the 16th of September, the Commission had an interview with His Imperial Majesty, the Tumo, or Mikado, which is said to have been rarely accorded to foreigners, and was given on a scale of unusual magnificence. In every way the Commission have been most favorably received, and the members pleased beyond all expectation.

HISTORY OF ICE-MAKING MACHINERY.

[Condensed from the Milk Journal.]

Cooling and ice machinery have been practically divided into two classes. First, those in which heat is directly applied in order to produce cold; as, for instance, in the air machines, where the air is first compressed and subsequently expanded, and in the ether machines, where the evaporation is effected *in vacuo*, the speed of the process being accelerated by the use of an air pump; and second, those machines in which cold is produced by direct heat without the aid of power, as, for example, in the latest ammonia machine. Each machine has its partisans, and dire battle is done occasionally; ink has flooded fields of paper, and thousands of broken pens must have strewn the lists. It is claimed for the air machine that it requires the assistance of no chemical agents; that the machinery acts direct upon the air and water; and that it will produce cold air, refrigerate fluids, or make ice continuously as wished, with the aid of fuel alone. On the other hand, it is claimed for the ammonia machine that more ice or heat reduction can be got out of the coal used by it than

Charles W. Brooks, Japanese Counsel at San Francisco. General Horace Capron, Chief of Commission. Prof. Thomas Antisell, Technologist and Geologist. Major A. G. Warfield, Jr., R.R. and Mining Engineer. Stuart Eldridge, M. D., Secretary of Commission.

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any other, the quantity needed being only what will suffice to boil a solution, and that the only power needed is that small amount which works the pumps and keeps the cold conveying fluid in motion. As for the ether machine, it is claimed for it that the construction is of the simplest, that it is cheaper to maintain than any other, and that the congelation commences with the first revolution of the flywheel. Outsiders, who are factionaries of no particular maker, would mostly look at freedom from accidents in dealing with the machines, giving preference to the ether machine, where the process is carried on in a vacuum, and the resistance to overcome does not exceed 15 lbs. per square inch, as against three times the amount in an air machine, and ten times the amount in some ammonia machines. Others would judge by the lowest temperature which the invention could register. As a rule, the best machine of any class will be found to be that which is the safest, occupies the least space, needs the smallest quantity of fuel, works the most continuously, makes use of the cheapest medium, is the least costly to maintain, can be worked by hand or power; above all, that which costs the least, and which the best fulfils other purposes when not used for its own specific work.

AIR MACHINES FOR PRODUCING COLD AND ICE.

Among the first machines of this description were those of Newton & Williams, introduced into notice about twenty years ago. The latter compressed the air and passed it in that condition through a close chamber containing a liquid of low temperature, which absorbed and carried off most of the heat produced by the compression. The condensed air was then led to expand, in contact with the substance to be cooled, from which substance the heat was gradually absorbed. The main points of the air machine are epitomized in the foregoing, but the modes of operation have been somewhat varied. Sundry other inventors followed in the wake, but it was not until 1862 that the production of ice was economically attained by the Kirk air refrigerator.

The success of this ice machine led Mr. Kirk, of Glasgow, to study, in its turn, the production of an article for cooling liquids without making ice, and he has, during the present year, constructed a machine for this purpose, capable of cooling 45 barrels of water at the rate of 15° per hour. Here the water which removes the heat caused by compression, and that to be cooled, are injected as a shower through the compressed and expanded air of the hot and cold chambers, and are withdrawn by simple valves. When driven with compound engines, a surface condenser is attached, which enables clear water for divers purposes to be warmed by the exhaust steam. The machine, moreover, works noiselessly, and is as simple as it is effective for common refrigerating purposes.

In the ice making air machine of Mr. Mignot, of Paris, especial means have been adopted to inject the water in the form of spray into the very midst of the air as it is being compressed in the compressing cylinder. The cold air produced, being about 60° below freezing point, is conveyed through a trough with large cells containing the water to be congealed, and escapes at about 4° above freezing point, which would be at a temperature enabling even more work to be done if wanted. The chief feature of interest in this machine, which last year attracted great attention, lies in the injecting of the spray, which slightly diminishes the work necessary to compress the air. Another point to be admired in it consists in the fact that the compression and expansion cylinders are placed in easy conjunction with each other, and so work simultaneously. It is just possible also that the ice produced at so low a temperature would outlast the natural ice.

In the air machine of Mr. Windhausen, of Brunswick, the air is admitted into the compressing chamber as usual, and thence passes into a condenser formed of two series of pipes, whence it enters the expansion chamber to be dilated and cooled. The air then escapes through a valve into the refrigerator, containing the vessels of liquid to be frozen, that is, if ice is wanted, or directly into the room to be cooled, if a reduction of temperature there is desirable. He employs either a single or double acting cylinder, compressing on one side of the piston and expanding on the other, or a double cylinder, one for compressing the air, and the other for subsequently expanding it.

The above represent the most successful machines of the present day for the production of cold by the alternate compression and expansion of the air. Whether the system can eventually be brought into still more economical restraint, depends, we think, mainly upon the improvements brought to bear upon the steam engine itself. For the steam engine is a law with this kind of ice machine. At present, air machines are reputed too costly to compete with, for instance, the ether machines. An ether machine of 12 horse power will favourably compare with a Windhausen machine of the same power; for the former takes up only a space of six superficial yards, and will produce 400 lbs. of ice per hour, whilst the latter occupies one half more space, and turns out but 300 lbs. of ice. Perhaps it will eventually be found that the air machine will be the one most suited for the artificial refrigeration of air, apart from ice making, inasmuch as the requisite amount of cold can be regulated with the greatest nicety by means of a valve under the control of the attendant.

AMMONIA MACHINES FOR PRODUCING COLD AND ICE.

As the machine of this kind which first attracted notice after Dr. Faraday had shown the possibility of obtaining cold by the liquefaction and subsequent gasification of ammonia, the ice machine of Mr. Carré, of Paris, demands a mention, not only for that reason, but because it is still peculiarly adapted for ice manufacture on a small scale. This machine is fully described on page 265, Vol. XXIII of the SCIENTIFIC AMERICAN.

Mr. Mort, in 1867, patented a process of producing a temperature suitably low for the preservation of animal food by an improved machine, where ammoniacal gas was liquefied by pressure, and made to absorb heat on its release from liquefaction, which is well worth attention; and in 1869 he protected a process in which, as he says, he avails himself of the known affinity that ammonia has for water, and claims that, with nothing but a peculiar pump and a simple apparatus, the whole process of producing cold is carried on, and substances are refrigerated and frozen without the necessity for any medium of transmission other than the ammoniacal liquor itself. In the earlier ammonia systems of Carré, Tellier, Reece, and others, liquefaction was carried on under pressure alone, but Mr. Mort's process is one of liquefaction by affinity, by the aid of a slight pressure. It is, however, difficult to explain these differences without the aid of experiments.

A recent ammonia machine is the one patented by Mr. Reece, of London. A generating vessel is charged with a solution of ammonia, and a fire is then lighted under the boiler, which expels all the air. A strong solution of ammonia is then pumped up to the top of an analysing cylinder above; and, as the solution descends the different plates there, it is in a great measure separated from the water by the steam rising from the generator or boiler. The nearly anhydrous ammonia is now passed into a rectifier, where it is completely cooled by a stream of cold water, and rendered completely free from watery vapour. The perfectly anhydrous ammonia now descends into a liquefactor, where it is liquefied by the mere pressure of the gas upon itself. When a sufficient accumulation has accrued, the fluid is then run into a cooling cylinder until the coil therein is full; and when that is effected, access is given therefrom to a second cylinder, where the liquid ammonia assumes its gaseous condition, cooling the liquid inclosed in the inclosed coil. The now exhausted ammonia traverses the coil in the cylinder to an absorbing vessel, where it meets with the exhausted liquor from the distilling vessel, or generator, and is dissolved. The solution is now pumped through a horizontal heater, where it meets with the liquor proceeding from the boiler into the top of the analysing cylinder, where the same series of operations are repeated. If water is required to be cooled, it is sent through the coil in the cooling cylinder direct; and when ice is desired, a solution of chloride of calcium is made to flow through the coil, and round the ice forming cells in which the ice is made. A drawback to the use of this machine is that it has to be worked up to an enormously high pressure, and, if imperfectly constructed, would induce a very serious explosion. Another objection is its cumbrousness, and non-adaptability to working when on shipboard.

ETHER MACHINES FOR PRODUCING COLD AND ICE.

The principle of the ether process is the production of cold and ice by the evaporation of this volatile liquid; but as its tension is otherwise too small, this is carried on *in vacuo*. A machine of this kind also permits the continuous re-use of the ether without loss, provided that the stuffing boxes are kept in perfect order. In Messr. Siebe's machine, the ether is removed by an air pump worked by hand or steam, and the air is then allowed to enter the refrigerator, where it becomes vaporized. It then traverses some branch pipes into the cylinder, and is forced through other pipes into a spiral coil surrounded by water, which acts as a condenser. An air vessel is constructed in the condenser, and sometimes an auxiliary condenser is placed in a bucket outside.

In passing through these coils the ether is liquified, and, parting with its heat to the environing water, is returned to the refrigerator. One adaptation of this machine is largely employed by brewers, who usually pass a continuous stream of water, or wort, through the apparatus, with a consequent reduction of 20° to 30° of temperature. Messrs. Siebe's machine, to make one ton of ice, will, they aver, cool 15,522 gallons of water, or 648 gallons per hour, 10°; whereas one ton of ice applied in the ordinary way will only cool 3,240 gallons, or 135 gallons per hour, 10°, showing a considerable waste to attend the use of ice by brewers, etc., and a great economy in the adoption of a refrigerating apparatus. In a similar way, we are informed that in Texas it takes 300 lbs. of ice to cool 1,000 lbs. of meat; and here, too, the ice machine is a necessity.

Professor Gamgee, during the past twelve months, has patented what he considers an improvement on the above kind of machine, viz.: by affording a greater area of conducting surface in proportion to the space occupied by the machine; in other words, he constructs his refrigerators and condensers on the tube within tube principle, and obtains a greater cooling power in consequence.

In working both the above machines, the ordinary ether is adopted; but the latest system of Mr. Tellier is based on the evaporation of an ether produced by the distillation of wood, and is carried on by him at Auteuil, near Paris, with marked success. This machine seems to be able to effect all that a refrigerating machine can effect, in the way of ice production and the maintenance of chambers at 28½° during the hottest summer months. Like the majority of ice machinists, he is now busy developing a scheme for the importation of meat. He proposes to subject Australian newly killed carcasses to his process of cooling, etc., and send them homewards in vessels fitted up with his cooling machines.

FREEZING POWDER MACHINES FOR PRODUCING COLD AND ICE

There are in the market of nearly every country some scores of differently constructed machines, varying in price, for the production of ice by the use of freezing powders.

An inexhaustible freezing compound, which can be reconstituted by exposing it in shallow vessels to the sun's heat, when the ultimate crystals, of which it is composed, can be collected, is sold by Messrs. Brown Brothers & Co., of London, who are also venders of a series of excellent block ice making machines, the smallest of which, the "Paragon," costs £3, turning out a half pound block in eight minutes, and the largest, the "Industrial, No. 4," costing £72, and producing fifty pounds of block ice in half an hour. Cheaper machines than even the "Paragon" are sold for icing creams and the like, but we need not enter upon them. Of course the cost of the freezing powders rules the question as to whether it is more expedient to make ice in this way than to purchase foreign ice.

We have now completed our remarks upon ice machines, properly speaking; and, in order to imbue the minds of our readers with an idea of the value of these machines, we may state that the Windhausen air machine patent for North America was sold for £22,500, and the French patent for 750,000 francs. As much as 40,000 dollars has also been obtained for the right of using the Carré machine in a single Texan province.

The Factories of England---Sufferings of Workmen.

In the course of an article on sanitary reform, in *Chambers' Journal*, an intelligent writer says:

"If we turn back to the unhealthy state of the air in factories and workshops, it may be observed that the workmen of all countries show such a carelessness about their health that the best reforms often fail through the want of their co-operation. In some trades, where poisonous substances are used, the masters have tried to enforce the wearing of gloves or the frequent washing of the hands; yet the men have refused to conform to such simple injunctions. At a manufactory in the neighborhood of Newcastle, the workmen threatened to leave because they were desired to take baths at certain intervals. But nevertheless, great improvements have taken place in the last fifty years. White lead which is one of the most dangerous compounds of oil paint, has been rendered almost innocuous; and the largest manufacturers can now boast that years will pass without any of their men being attacked by colic; this is chiefly due to strict attention to the laws of cleanliness. The making of matches requires many dangerous operations, such as dipping the bunches into inflammable paste and placing them, when finished, in boxes. In the first of these the maker constantly breathes phosphoric vapor, and in the second, which is chiefly performed by women, spontaneous combustion frequently occurs, causing serious wounds on the hands. These have both been remedied by using machines instead of the hands, and a still greater benefit has arisen by a different preparation of phosphorus being employed.

"The Sheffield cutlers have suffered severely from the sharpening of steel knives and needles; the fine dust entering the mouth and nostrils, and the constant stooping over the grindstone deforming the chest. The preparation of skins and leather places the currier in an unwholesome atmosphere; and the cotton mills of Lancashire have a bad reputation. Ventilation is the principal remedy against these maladies.

"As for the long trail of smoke which our large factories emit from their chimneys, much has already been done to lessen it, though there is still great room for improvement. At one time, it was suggested that if they were built to an immense hight, the smoke would cease to be noxious, and Glasgow points with pride to some of these columns, higher than any building in the world excepting the spire of Strasburg cathedral and the largest pyramid of Egypt. But this was a very imperfect proceeding. There was nothing in the air to neutralize these emanations, and though the particles fell at a greater distance, attenuated, it is true, they were just as mischievous. Coal smoke is very disagreeable, but other gases from chemical works act as a mortal poison on vegetation. Such are the nitrous and sulphuric vapors from the manufactories of these acids; whilst the smelting of iron ore renders a country sterile for miles round. One of the most curious effects of this kind is to be found in the smoke of lime kilns on the vineyards of France; it gives the grapes and wine for some distance round a disagreeable taste; and in Burgundy, the kilns are always interrupted in their work from the time of the flowering of the vines to the season of ingathering. In the previous cases, condensation of the injurious vapors before leaving the chimney has been found eminently serviceable."

Fire-Proof Buildings---Views of the Sculptor, Mr. Hiram Powers.

The Providence *Journal* publishes a letter from Mr. Hiram Powers to a citizen of Rhode Island, in which, after alluding to the burning of Chicago, he says:

But it may be asked, "Is it possible to make a city fire-proof?" I answer, yes, and without any great extra expense. To prove this, I have only to say that, although there have been frequent fires in the city of Florence during the thirty-four years of my residence in it, not one house has been consumed, except a theatre, and that was not entirely destroyed. Rooms, full of goods, have been heated like ovens by ignited calicoes, straw hats, etc., but as the floors above and below were all covered by thin brick tiles, the goods burned without ventilation. And as there was no flame, a smell like that of a coal pit soon gave the alarm, and the fire was soon extinguished by no other engine than a squirt holding about a gallon, which discharged a well directed stream through some aperture. I once beheld some firemen marching to a fire in Florence. Foremost were three men with picks, next four men with buckets, then three men with highly polished brass squirts on their shoulders; all marching with an air of pomp and importance. The fire was at the residence of Mr. Clevenger, the Ameri-

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can sculptor, and had been burning twenty-four hours on the end of a joist just under his fire place. He had smelt something like a coal pit for some time, and at length perceived smoke rising from the brick floor. On going below he found the room full of smoke, and a rush bottomed chair just under the joist was partially consumed. But the joist was not yet burned off, and why? Because the fire was bricked down. It could not rise and burst into flames.

The secret of fireproof building then is this: It must be made impossible for the flames to pass through the floors or up the stairway. If you will have wood floors and stairs, lay a flooring of the thinnest sheet iron over the joists, and your wood upon that; and sheath the stairs with the same material. A floor will not burn without a supply of air under it. Throw a dry board upon a perfectly flat pavement and kindle it as it lies, if you can. You may make a fire upon it and in time consume it, but it will require a long time. Prevent drafts, and though there will still be fires no house will be consumed. The combustion will go on so slowly that discovery is certain in time to prevent any great calamity.

But the roofs, how about them? Slate or tiles? Zinc melts too easily. I believe that hard burned tiles, if flat, would stand the frost at home; and if so, they constitute the best roofing. My house has no joists. All the floors are of tiles resting on arches. One of these arches was made over a room twenty five feet square, by four men in four days. The bri ks are about one and a half inches thick, and laid edgewise with plaster of Paris. There was no framework prepared to lay them on, unless you would so term four bits of wood which a man could carry under his arm. And yet this arch is so strong as to be perfectly safe with a large dancing party on it. I never have heard of one of those floors falling, and they are absolutely fireproof. Of course light arches like these would not do for warehouses.

It would pay, I think, to send out here for an Italian brick mason who knows how to build those thin but strong arches for dwelling houses. I know that there is a prejudice at home against brick or composition floors. "Too cold in winter," it is said. And so they are if bare, but cover them with several thicknesses of paper and then carpet them, and no one can distinguish the slightest difference between their temperature and that of wood floors. Who doubts this, let him try the experiment with the feet of the thermometer. The truth is that the brick or composition floor is no colder in itself than wood—the thermometer attests this—but it is a better conductor. I do not insure my house, as I know that it is not combustible.

SODA.

One of the chemical discoveries of the present century, the applications of which are the most varied, and the history of which is the least known, is the manufacture of soda. It is a metallic oxide; that is to say, the combination of a metal with oxygen. Like potash, with which it has many affinities and many common uses, it belongs to what the Arabs called, in the ninth century, alkalies,—a name which, as well as alchemy, has been adopted in most European laboratories. It has a strong affinity for acids, and combines with them to form various salts. This property is made use of in trades of various kinds, as, for instance, in scouring cloths that must be freed from greasy matters, and also in the manufacture of soap. The white and marbled soap has not even yet lost its superiority, and still occupies a first place among similar products of other nations. It is made by combining soda with the acid fat of olive oil.

The glass manufactories also consume an immense quantity of soda. Glass is composed of flint and different alkaline bases, such as potash, soda, lime, and barytes. Certain mineral oxides give it a variety of color, sometimes of a very undesirable kind. Should the paste contain traces of iron, instead of producing white glass there will be only the common bottle glass; and if the iron be in larger proportions, the dark green shade will be the result. On the contrary, add a certain quantity of oxide of lead to a pure base of potash, and the beautiful crystal glass is formed; a still larger dose, and the diamond paste, with its wonderfully dispersive power, will deceive many an unpractised eye. Between these extremes, the dull bottle and the many sided crystal, there is the window glass, which adds so much to the comfort and health of our houses, the gorgeous looking glasses to adorn our drawing rooms, the rich decorations for the dining table, the crystal pendants of our gaseliers, and many other objects which satisfy our commonest necessities, and minister to the highest taste or luxury.

When marine salt is acted upon by sulphuric acid, an acid gas is thrown off, and sulphate of soda remains. In the time of Leblanc, chemists were ignorant of the composition of the gas which escapes, and gave it the name, for want of a better, of muriatic acid; and marine salt was supposed to be a composition of this acid and soda, which was an error. In the present day, it is known that marine salt is composed only of soda and chlorine, and that muriatic acid consists of hydrogen and chlorine. Neither Leblanc nor his companions suspected the real case, that sulphuric acid could have no power over salt without the intervention of water. It is this simple agent, which, by decomposing, furnishes oxygen for the sodium, and hydrogen for the chlorine; giving, as a result, the soda which combines with the sulphuric acid, and a gas which flies off, now called, to adopt the more exact name of the new system, hydrochloric acid. Without water there could be no reaction; happily, it was always present in the sulphuric acid that was employed, and consequently this error in theory had no influence over the result in action. We have now reached the point of obtaining sulphate of soda; to obtain the common soda, it is necessary to divide it from the sulphuric acid, which was altogether Leblanc's discovery. Most chemists proposed a solution of this difficult question by heating the sulphate with various bodies; he laid his hand upon the one which gave the best results,—chalk (carbonate of lime) and charcoal. It is singular that he did not even know the exact theory of the reaction this produces, which latter chemists have fully defined; but his instinct was so sure, his first experiments were conducted with such accuracy, and the quantities were so irreproachably defined, that later years have in no degree changed the manufacturing process which Leblanc first laid down. First came the decomposition of marine salt by sulphuric acid; then the decomposition of sulphate of soda by the heated kiln, and the washing of the rough soda on the floor of the kiln.

SULPHURIC ACID.

From the first of these operations, one of the most important articles in modern industrial occupation intervenes—that of sulphuric acid. In a few years, a way of making it in large quantities was discovered, and the face of all chemical operations was changed. It is by the help of it, that, directly or indirectly, chemists are enabled to extract from the different salts the greater part of the acids used in laboratories and in the arts. Thanks to it, hydrochloric acid has been economically obtained, which has rendered such service in paper making, bleaching, dyeing of stuffs, also serving for the preparation of gelatin, of ammoniacal salts, and of disinfectants. Next is carbonic acid, which is used in the manufacture of soda water and all effervescent drinks, in the extraction of sugar from beet root, and the fabrication of alkaline bicarbonates; and last of all is azotic acid, the most powerful agent of oxidation, which dissolves all metals, even gold and platina, when united to hydrochloric acid, and is indispensable to the workers in metals. By sulphuric acid, phosphates are transformed into powerful manures; sulphates of aluminium, of potash, of magnesia, of ammonia and of iron are economically obtained, with many other important applications in agriculture, medicine, and domestic economy. The production of electric currents, of electro-chemical gilding and plating, the refining of gold and silver, the making of stearine candles, the purification of colza and other oils, the dissolution of indigo, are some among many other branches of trade which could not be carried on without sulphuric acid; and its being manufactured in such large quantities is entirely owing to the soda works.

HYDROCHLORIC ACID.

One of the most serious embarrassments arose from the immense quantity of hydrochloric acid which was poured out from the soda works in the form of gas. It was condensed as much as possible by passing it through a series of vessels full of water, thus obtaining acid dissolutions, which had a certain value; but more was produced than could be disposed of. Besides, much e caped into the atmosphere in the shape of corrosive acid vapor, which attacked the iron parts of buildings, dried up the leaves of the trees, and exercised a most pernicious influence on the health of the surrounding neighborhood. The winds carried it away to great distances, and the effects were perceptible miles away. The proprietors had to pay heavy damages; and it became a matter of existence or non existence to the soda works to find a means of condensing and collecting this deleterious acid. All these difficulties have been surmounted; and as it has often happened in chemistry, each has become the means of fresh progress. One of the most curious plans tried to purify the air was to build the works near to old abandoned quarries, and to bury the inconvenient vapors in their depths; but the acid, penetrating the stone, rendered it moist and friable, so that portions fell, and houses built in the neighborhood were rendered unsafe. Two different arrangements are now adopted, both succeeding perfectly. One is to pass the gas through many hundreds of stone bottles, communicating with each other through well luted tubes; a current of water is driven through them in an opposite way to the gas, and the smallest portion of hydrochloric acid is thus dissolved. Another plan is what is called the absorbing cascade; a high, wide tower is built of flintstones, the interior of which is filled with coke, fragments of flint, or bricks set apart; the gas is introduced at the base, and before it can escape it has to pass through all the interstices of these hard materials. From above, a fine rain of water is continually falling, and, meeting the gas at every angle, retards its progress and absorbs the acid.—*Chambers' Journal.*

Experimental Science at Cornell.

Professor B. G. Wilder, Professor of Comparative Anatomy and Zoology, at Cornell University, Ithaca, N. Y., calls upon all persons, who desire to facilitate the cause of science, and the instruction of the young men under his charge, to send him specimens for dissection. For every specimen a written acknowledgment will be sent, and eventually, to each donor, a copy of any scientific paper in which may hereafter be embodied the result he will have helped to reach. The specimens may be sent at his expense as above. The package, if large, may be sent as freight; if small, by express. He says:

"We want brains of all animals, both wild and domesticated; nothing can be amiss, for if duplicates come of what we already have, the students can dissect the brains, or the skulls, if desirable, can be prepared. When possible, the size and weight of the animals should be noted; and especially the sex and apparent age. The most valuable collection that could be sent us would include a male and a female, an old and a young, of the same species, the size and weight, the age and sex being marked in some way upon the specimens themselves; these would be worth more than fifty heads of different animals and bearing no such information. When the animals are small, or any doubt could arise as to their specific identity, they should be sent entire; but if large, the heads alone. Of course, a badly damaged head would not be worth the sending, unless very rare; and in all cases the killing should be so accomplished as to avoid injury to either brain or skull; the head should be cut off with one or two of the neck vertebræ attached, so as to save the *medulla oblongata* at the nape of the neck, and should be kept in a cool place before sending.

"We want the unborn young of all animals, and at all stages of development; as a rule, the smaller the better, but, as with the brains, hardly any specimen of this kind would be amiss: for where it is too large for entire preservation in alcohol, special organs may be prepared (the brain, stomach, etc.), so as to be extremely useful in showing the manner of the animal's development. On account of the extreme delicacy of these specimens, great care must be exercised in procuring and sending them. When possible, they should be kept and sent in the womb, the fluid contents of which are the best protection; but if this cannot be, then they should be placed in a jar or can with water and a little salt; larger embryos (colts, calves, etc.) may be laid upon hay or tow, and packed in a box, great care being had to prevent any pressure upon the head, for the skulls of unborn animals are so soft as to yield, and the brains are then ruined. Still-born or aborted animals are particularly useful if the time since conception is known; but embryos are often found in animals killed in the chase or for food. Of course, the species from which the embryos are taken should be noted, and, in case of domesticated animals, the exact breed so far as known; the pure breeds are most valuable for both brains and embryos, such as the ass, the mule, the different breeds of horses, the Newfoundland dog, and indeed nearly all the breeds of dogs, the brains of which differ among themselves to a wonderful extent.

"Such monsters as animals with two heads or two tails, or an unusual number of limbs or toes, or with but a single eye in the center of the face, etc., usually die soon after birth, and are then looked upon as mere curiosities, and so thrown away. Such specimens are of the greatest value to science. Gœthe, who was naturalist as well as poet, well said: 'It is in her monstrosities that Nature reveals to us her secrets,' and many of the more obscure laws of life and organization have been elucidated by the aid of these unfortunate creatures, which go astray before they are born, and live only to die. The not infrequent occurrence of such malformations among the human race should alone induce a careful study of whatever may lead to a knowledge of their nature and possible causes. There are few persons, especially living in the country or upon farms, who have not occasional opportunities of procuring such specimens as we desire; but none are so likely to have them as the hunters, the butchers, and the stock breeders; let me ask all such to save and send the specimens that almost daily come into their hands. Their value to us and to science is not to be estimated by the little trouble it may take to procure them, or the price which ignorance sets upon them."

Advantage of Californian over European Wine Growers.

In Europe, they only reckon to secure in ten years one good crop and fine quality, and two more crops of fine quality, but small quantity; while seven vintages are reckoned as being of poor quality, small quantity, and total failures. In our State, the variation in quality seldom amounts to five per cent, while the most disastrous years have not lessened the crop below the ordinary yield more than twenty-five per cent in quantity. This very variation in quantity can be fully known three months previous to the vintage, thus allowing the producer ample time to secure his casks, and furnishing him positive knowledge as to the number required. In other countries, even fourteen days before the vintage, there is no certainty of a crop; a wind, a rain, or a hail storm is apt to occur at any moment and devastate the entire vintage. All is uncertainty there; nor has the vintner any possible means of positively ascertaining how many casks he must provide. In abundant years in the old countries, the exchange has often been made of so many gallons of wine for an equal number of gallons capacity of casks. The disadvantages of being forced to secure such immense quantities of casks in so limited a period are too easily perceived, and we certainly cannot appreciate our own advantage too much in being very differently situated.

Another great benefit, derived from the long continuance of the dry weather, is the exemption from weeds in our vineyards after the final plowing. Thus all the nourishment and strength of the soil go wholly to their destination, the vine, and hence the vigorous appearance that even the most delicate imported varieties acquire even in our poorest soils. They necessarily bear much more. This circumstance will also explain, in a measure, why our cultivation does not cost as much per acre as that in European countries, though our labor is so much higher. The advantage of our dry weather does not end here; it precludes the possibility of continued mildew, and allows the vintner to leave his vines unstaked, the bunches of grapes actually lying and securely ripening upon the very ground, without fear of frost or rotting. In this condition, the grapes mature sooner, are sweeter, and, it is believed, possess more flavor.—*Overland Monthly.*

PRESERVATION OF STONE.—Doctor Eugéne Robert, of Paris, recommends copper salts as being the best preservatives of stone in a damp climate. These salts prevent the formation of lichens, to the action of which M. Robert attributes the destruction of stone. This is, without doubt, true for granite, but its efficiency for sandstone is questionable. The latter deteriorates by exfoliation, without the development of any vegetation.—*Les Mondes.*

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