

extremely fine particles of mineral dust may exist in the atmosphere, while escaping detection by our senses, and such an occurrence is probably more frequent than generally thought.

Prof. Piazzzi Smyth, while on the Peak of Teneriffe, witnessed strata of dust rising to a height of nearly a mile, reaching out to the horizon in every direction, and so dense as to hide frequently the neighboring hills. The report of the Krakatao Commission of the Royal Society contains the following interesting account, p. 421 (Mr. Douglas Archibald's contribution to the report):

"In 1881 Prof. S. P. Langley ascended Mount Whitney, in Southern California, with an expedition from the Alleghany Observatory. At an altitude of 15,000 feet his view extended over one of the most barren regions in the world. Immediately at the foot of the mountain is the *Inyo Desert*, and in the east a range of mountains parallel to the Sierra Nevada, but only about 10,000 feet in height. From the valley the atmosphere had appeared beautifully clear, but, as stated in Prof. Langley's own words, 'from this aerial height we looked down upon what seemed a kind of level dust ocean, invisible from below, but whose depth was six or seven thousand feet, as the upper portion only of the opposite mountain range rose clearly out of it. The color of the light reflected to us from this dust ocean was clearly red, and it stretched in every direction as far as the eye could reach, although there was no special wind or local cause for it. It was evidently like the dust seen in midocean from the Peak of Teneriffe—something present all the time, and a permanent ingredient of the earthy atmosphere.'"

Dust Storms.—These storms, as suggested by Dr. Henry Cook, from whose paper to the *Quarterly Journal* of the Royal Meteorological Society, in 1880, I am now quoting, may be considered under three heads, according to their intensity—atmospheric dust, dust columns, and dust storms. Dr. Cook, alluding to occurrences in India, observes that there are some days on which, however hard and violently the wind may blow, little or no dust accompanies it, while on others every little puff of air or current of wind forms or carries with it clouds of dust. If the wind which raises the dust is strong, nothing will be visible at the distance of a few yards, the sun at noon being obscured. The dust penetrates everywhere and cannot be excluded from houses, boxes, and even watches, however carefully guarded. The individual particles of sand appear to be in such an electrical condition that they are ever ready to repel each other, and are, consequently, disturbed from their position and carried up into the air.

Dust columns are considered by Dr. Cook as due to electrical causes. On calm, quiet days, when hardly a breath of air is stirring, and the sun pours down its heated rays with full force, little eddies arise in the atmosphere near the surface of the ground. These increase in force and diameter, catching up and whirling round bits of sticks, grass, dust, and, lastly, sand, until a column is formed of great height and considerable diameter, which usually, after remaining stationary for some time, sweeps away across country at great speed. Ultimately it loses gradually the velocity of its circular movement and disappears. In the valley of Mingochar, which is only a few miles in width, and surrounded by high hills, Dr. Cook, on a day when not a breath of air stirred, counted upward of twenty of these columns. They seldom changed their places, and, when they did so, moved but slowly across the level tract. They never interfered with each other, and appeared to have an entirely independent existence.

Dr. Cook describes as follows a dust storm which took place at Jacobabad:

"The weather had been hot and oppressive, with little or no breeze, and a tendency for dust to accumulate in the atmosphere. On the evening of the storm heavy clouds gathered and covered the sky. About 9 p. m. the sky had cleared somewhat, and the moon shone. A breeze sprang up from the west, which increased and bore along with it light clouds of sand. At 9.30 p. m. the storm commenced in all its fury. Vast bodies of sand were drifted violently along. The stars and moon were totally obscured. It became pitch dark, and it was impossible to see the hand held close to the face. The wind blew furiously in gusts, and heaped the sand on the windward side of obstacles in its course. Lightning and thunder accompanied it, and were succeeded by heavy rain. The storm lasted about an hour, when the dust gradually subsided. The sky again became clear, and the moon shone brightly. The storm appeared to have entirely relieved the electrical condition of the atmosphere. A pleasant freshness followed, and the oppressive sensation before mentioned was no longer experienced. This, indeed, is the general effect of storms in Upper Seind. The air is cooled, the atmosphere cleared, and the dusty condition of the atmosphere which usually precedes them for several days completely disappears."

In the case of a memorable sand storm which occurred at Aden on July 16, 1875, and recorded by Lieut. Herbert Russell, there was a remarkable play of light on the objects which remained within sight. The sudden darkness from the storm gave a peculiar and ghastly tint to the white sand and neighboring plain, while the curling masses of sand drifted before the gale, resembling a dark yellow smoke. The varied lights quickly changing were curious and most grand, the sea a clear green, and Slave Island and Shum-Shum, usually of an arid brown color, became of an ashy white.

In a dust storm I experienced myself at Luxor, on the Nile, the suffocating effect of the sand as it drove into the lungs and air passages was very trying. People rushed to the immediate river side, where some relief was found.

A book on "Whirlwinds and Dust Storms in India," by P. L. H. Baddeley, surgeon, Bengal army, 1860, gives some interesting information on the electrical character of dust storms and dust pillars. When at Lahore, in 1847, this gentleman was desirous of experimenting on the electrical state of the atmosphere in a dust storm, and with this object he projected into the air, on the top of his house, an insulated copper wire fixed to a bamboo; the wire was brought through the roof into his room, and connected with a gold-leaf electrometer, a detached wire communicating with the earth. A day or two after, during the passage of a small dust storm, he observed the occurrence of vivid

sparks from one wire to the other, and, of course, strongly affecting the electrometer. He subsequently witnessed at least sixty dust storms of various sizes, all presenting the same kind of phenomena.

Volcanic Dust.—This dust consists mainly of powdered vitrified substances, produced by the action of intense heat. It is interesting in many respects. The so-called ashes or scories shot out in a volcanic eruption are mostly pounded pumice, but they also originate from stones and fragments of rocks which, striking against each other, are reduced into powder or dust. Volcanic dust has a whitish-gray color, and is sometimes nearly quite white. Thus it is that, in summer, the terminal cone of the Peak of Teneriffe appears from a distance as if covered with snow; but there is no snow on the mountain at that season of the year. The white cap on the peak is entirely due to pumice ejected centuries ago. It is probably to this circumstance that the island and peak owe their name, as in the Guelph language the words *Tener Ifa* mean *white mountain*.

The friction caused by volcanic stones and rocks as they are crushed in their collision develops a mass of electricity which shows itself in brilliant displays of branch lightning darting from the edges of the dense ascending column. During the great eruption of Vesuvius, in 1822, they were continually visible, and added much to the grandeur of the spectacle. It not unfrequently happens that dust emitted from Vesuvius falls into the streets of Naples; but this is nothing in comparison with the mass of finely powdered material which covered and buried the towns of Pompeii, Herculaneum, and Stabiae in the year 79.

On this occasion, according to the younger Pliny, total darkness from the clouds of volcanic ashes continued for three days, during which time ashes fell like a mantle of snow all over the surrounding country. When the darkness cleared away, the calamity was revealed in all its awful extent, the three towns having disappeared under the showers of dust.

The eruption of Krakatao, a mountain situated on an island in the Straits of Sunda, exceeded, in all probability, in its deadly effects, and as a wonderful phenomenon of nature, the outburst of Vesuvius in the year 69. The Krakatao Committee of the Royal Society have collected and published in their interesting report particulars of that memorable eruption, all of them thoroughly authenticated and reliable. The following is extracted from a communication to the report by Prof. Judd:

"On August 26, 1883, it was evident that the long continued moderate eruptions of Krakatao had passed into the paroxysmal stage. That day, about 1 p. m., the detonations caused by the explosive action attained such a violence as to be heard at Batavia and Buitzenborg, about one hundred English miles away. At 2 p. m. Captain Thompson, of the *Medea*, then sailing at a point seventy-six miles east-northeast of Krakatao, saw a black mass like smoke rising into the clouds to an altitude which has been estimated at no less than seventeen miles (nearly six times the height of Mont Blanc)."

If this surmise be correct, some idea of the violence of the outburst can be formed from the fact that during the eruption of Vesuvius in 1872 the column of steam and dust was propelled to a height of from four to five miles only.

At 3 p. m. the explosions were loud enough to be heard one hundred and fifty miles away. At Batavia and Buitzenborg the noise is described as being like the discharge of artillery close at hand. Windows rattled, pictures shook, but there was nothing in the nature of earthquake shocks—only strong air vibrations.

Captain Wooldridge, of the *Sir R. Sale*, viewing the volcano at sunset on the 26th, describes the sky as presenting a most terrible appearance, the dense mass of cloud of a murky tinge being rent with fierce flashes of lightning. At 7 p. m., when from the vapor and dust clouds intense darkness prevailed, the whole scene was lighted up by electrical discharges, and at one time the cloud above the mountain presented the appearance of an immense pine tree, with the stem and branches formed of volcanic lightning. The air was loaded with excessively fine ashes, and there was a strong sulphurous smell. The steamer *G. G. Loudon*, within twenty or thirty miles of the eruption, passed through a rain of ashes and small bits of stone.

Captain Watson, of the ship *Charles Bal*, at a spot about a dozen miles off the island, records the phenomena of chains of fire appearing to ascend between the volcano and the sky, while on the south side there seemed to be a "continual roll of balls of white fire." These appearances were doubtless caused by the discharge of white hot fragments of lava rolling down the sides of the mountain. From midnight till 4 a. m. explosions continually took place, the sky one second being intense blackness, the next a blaze of fire.

All the eye witnesses agree as to the splendor of the electrical phenomena. Captain Wooldridge, viewing the eruption from a distance of 40 miles, speaks of the great vapor cloud resembling an immense wall, with outbursts of fork lightning, like large luminous serpents, rushing through the air. After sunset this dark wall assumed the appearance of a blood red curtain, with the edges of all the shades of yellow—the whole of a murky tinge, and attended with fierce flashes of lightning. It was reported from the *Loudon* that lightning struck the mast head conductor five or six times and that the mud rain which covered the masts, rigging, and decks was phosphorescent. The rigging presented the appearance of St. Elmo's fire, which the native sailors were busily engaged putting out with their hands, alleging that, if any portion found its way below, a hole would burst in the ship; not that they feared the ship taking fire, but they thought the light was the work of evil spirits, and that if it penetrated the hold of the vessel, the evil spirits would triumph in their design to scuttle the ship.

By these grand explosive outbursts the old crater of Krakatao was completely eviscerated, and a cavity formed more than 1,000 feet in depth; while the solid materials thrown out from the crater were spread over the flanks of the volcano, forming considerable alterations in their form.

The sea disturbance which accompanied the eruption of Krakatao was carefully investigated by Captain Wharton, hydrographer to the Admiralty: "The rush of the great sea wave over the land, caused by the

violent abrasion in the crater, aided by the action on the water of enormous masses of fallen material, caused great destruction of life and property in the Straits of Sunda. By the inrush of these waves on land, all vessels near the shore were stranded, the towns and villages near the coast devastated, two of the light-houses were swept away, and the lives of 36,380 of the inhabitants sacrificed. It was estimated that the wave was about 50 feet in height when it broke on the shore."

On the morning of the 27th, between 10 and 11 a. m., three vessels at the eastern entrance of the Straits encountered the fall of mingled dust and water, which soon darkened the air and covered their decks and sails with a thick coating of mud. Some of the pieces of pumice falling on the *Sir R. Sale* were said to have been of the size of a pumpkin. All day on the 27th, the three vessels were beating about in darkness, pumice dust falling upon them in such quantities as to employ the crew for hours in shoveling it from the decks and in beating it from the sails and rigging. At Batavia, 100 miles from Krakatao, the sky was clear at 7 a. m., but at 11 a. m. there fell a regular dust rain; at 11.20 complete darkness pervaded the city. The rain of dust continued till 1, and afterward less heavily till 3 p. m.

The speed and distance attained by the pumice ejected from the volcano may be conceived from the fact stated in Mr. Douglas Archibald's contribution to the report, that dust fell on September 8, more than 3,700 English miles from the seat of the eruption.

The great mass of pumice thrown out during the eruption presented a dirty grayish white tint, being very irregular in size. It was undoubtedly due to the collision of fragments of pumice as they were violently ejected from the crater; the noise produced was even more striking than the sound of the explosion.

The dust ejected from Krakatao did not all fall back at the same time upon the sea and earth; as the lightest portions formed into a haze, which was propagated mostly westward. Mr. Archibald states in the report that most observers agree upon considering this haze as the proximate cause of the twilight glows, colored suns, and large corona, which were seen for a considerable time after the eruption. The haze was densest in the Indian ocean and along the equatorial belt, and was often thick enough to hide the sun entirely when within a few degrees from the horizon.

And now, ladies and gentlemen, I must bring this address to a conclusion, and thank you for having followed me over a long dusty track. I hope I have succeeded in showing that infinitely small objects, no larger than particles of dust, act important parts in the physical phenomena of nature, just as small and apparently unimportant events occasionally lead to others of the greatest magnitude.

A PROCESS FOR DECOMPOSING COMMERCIAL NICKEL AND ITS SALTS AND GALVANICALLY COATING OBJECTS WITH PURE NICKEL.

By Prof. GERHARD KRUSS, Lecturer at the University of Munich.

ACCORDING to experiments, made by the author, metallic nickel, regardless of the known technical impurities contained therein, for instance, iron, copper, arsenic, manganese, silicon, etc., is not a chemical element, but an alloy. This alloy contains averagely about 98 per cent. of a metal similar indeed in its properties to the substance hitherto named "nickel," but finer in various respects, which metal I will designate with "Ni," and about 2 per cent. of an element considerably differing from nickel in its properties and in the nature of its compounds. This element shall for the present be designated with "X."

Ni, free from X, that is to say, nickel in the new sense of the word, is produced from common nickel, nickel salts, or direct from the solutions of the raw materials obtained by concentration smelting, by proceeding according to the different nature of these elements. It is impossible to separate pure Ni by one operation from the said alloy of Ni and X, very rich in Ni, as the combinations of X also if insoluble in the residue of their precipitant, are soluble in Ni salts, therefore resist separation from the latter. It is therefore necessary to repeat one of the hereafter mentioned operations several times, or preferably several of these operations are successively performed to obtain pure nickel. Said operations are derived from the following peculiar properties of the compounds of the element X.

The neutral chloride, which is colorless—

(1) When treated with concentrated alkali lyes or melted with caustic alkali, is not changed into a hydroxide insoluble in water, but any hydroxide produced is wholly or partly converted into a combination of alkali soluble in water. The snow white hydroxide precipitated by means of common alkali lye, for instance, a normal solution, is, however, very little soluble in the latter, also with the addition of a large residue of the precipitant.

(2) Is but incompletely precipitated in solution through oxalic acid at a low as well as at a high temperature, more completely, however, through oxalate of ammonium, even at a low temperature after short standing. A very great residue of the latter precipitant can return the precipitant into solution.

(3) Is not precipitated in solution through fixed alkali lyes or ammonia, oxalate of ammonium or oxalic acid, even at a high temperature, if the solution has been previously acidified by the addition of organic acids, for instance, acetic acid, citric acid, pyrotartaric acid, etc.; whereas the soluble double oxalates of Ni are decomposed, on heating their solution, by one of the said acids, and deposit insoluble oxalate of nickel. If the combinations of the element X are, in solution or otherwise, brought in contact with a metal which is more electro-positive than Ni, for instance, with zinc, the compounds are not reduced even by short heating.

All these properties inherent on the pure X-compounds are to a different extent or completely altered and concealed if a solution contains besides X-salts also combinations of Ni. This is the case in the nickel salt solutions of former designation. The white hydroxide of X, for instance, is not at all precipitated by ammonia, if, in a nickel salt solution of former designation,

more than 70 per cent. of the dissolved substance consists of Ni salt.

If the nickel raw materials obtained by concentration smelting contain mixtures rich in X, of Ni and X, or of their salts, or solutions rich in X, of commercial nickel or commercial nickel salts, the neutral solutions to separate the Ni from the X are mixed with ammoniacal oxalate of ammonium, till the precipitate produced is redissolved. Subsequently they are allowed to stand for some time, white basic oxalate of X being thereby precipitated, and some more ammoniacal oxalate of ammonium is added. This addition is repeated until, after some longer standing, the quantity of the white precipitate ceases to increase. The blue liquid above the precipitate having been evaporated, its residue is thoroughly glowed and then mixed with such a quantity of muriatic acid as is required for solution. The solution of chloride is subsequently concentrated, and while heating it, solid hydrate of soda, up to five times the weight of the chloride, is incorporated therein, the doughy mass thereby produced being kept melting for a short time. The molten mass when cooled is broken up and brought in small pieces into ice cold water, care being taken, if necessary by the addition of ice, to prevent the temperature of the liquid from rising above 10° C. Thereby the sodium compound of the oxide of X is dissolved, while rather pure hydroxide of Ni remains undissolved. The alkaline liquid containing X having been poured or drawn off after some standing, the hydroxide of Ni is washed by decantation and dissolved in weak mineral acids or in acetic acid. This solution is mixed with such organic acids as are also capable of preventing the aluminum from being precipitated through alkalies, for instance, with acetic acid, pyrotartaric acid, or citric acid. On adding soda lye to the liquid thus obtained, while heating, pure hydroxide of Ni, free from X, is precipitated; or pure oxalate of Ni, free from X, can be produced in boiling heat by precipitating the said solution of nickel, acidified with an organic acid, with soluble oxalates, for instance, oxalate of ammonium, all X being thus kept in solution, as by the preceding operations the greater part of X has already been eliminated from the commercial nickel or its salts.

In lieu of this, however, also the solutions of commercial nickel, of its salts, or of the nickel raw materials obtained by concentration smelting, and the nickel compounds produced by the above treatment may be decomposed into pure nickel (Ni) or its salts and the element X or its compounds respectively, by bringing the nickel compounds or solutions referred to in contact with a metal which is more electro-positive than the Ni metal itself.

Nickel salts are in this manner more easily reducible, and, for instance, a solution of sulphate of nickel, chloride of nickel, or nitrate of nickel is soon almost completely decolorized when warming it with zinc dust or fine zinc chips, nickel metal being precipitated and zinc brought in solution as sulphate. The compounds of X are thus not reduced and remain in solution.

If the neutral or weak acid solutions of the nickel raw materials, obtained by concentration smelting, or like solutions, of commercial nickel or nickel salts contain but few X compounds, pure nickel can be obtained from them by performing once or twice one of the two last described operations.

The pure nickel obtained by the above described process is particularly adapted for galvanically coating objects. While the nickel obtained by the processes already known has a brownish yellowish hue, owing to the metal hereinbefore named X, inherent thereto, the color of pure nickel (Ni), if not perfectly free from a yellowish shade, is decidedly more like silver and lighter, its application consequently preferable to the galvanic nickeling heretofore in use. To this end, any of the known processes may be applied by using nickel salts free from X for producing the alkaline neutral or acid nickel baths, and as nickel anodes such of nickel free from the element X, or from its oxide.

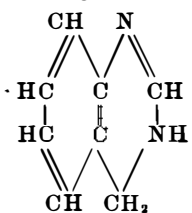
Having now particularly described and ascertained the nature of this invention, and in what manner the same is to be performed, I declare that what I claim is:

(1) The process for decomposing commercial nickel and its salts into pure nickel (Ni) or into pure nickel salts and into an element, designated with "X" in the specification, or its salts, that is to say, the process for producing such metals (Ni and X) and their compounds, substantially as described.

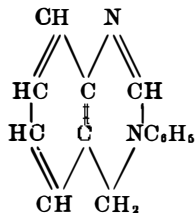
(2) The application of nickel, free from the element designated with X in the specification, or of the salts of such nickel for galvanically coating objects.—*Chem. News.*

OREXIN.

ANOTHER complex chemical compound has during the past month made its appearance as a candidate for a place in the materia medica, the claim of the new comer, for a wonder, not being that it is an antipyretic or an analgesic, but a stomachic and appetite producer, for which reason it has been named "orexin." As there are signs that the virtues of this compound will not be hidden under a bushel, some information as to its nature may be useful in the event of interest in it being aroused. Orexin is one of a series of compounds recently prepared synthetically by Messrs. Paul & Busch (*Berichte*, xxii., 2683). It is described as being a derivative from chinazolin, a term applied to a compound represented by a structural formula differing from that of chinoline in having two CH groups of a naphthalene ring replaced by N, instead of one. In dihydrochinazolin there is an imide group, the hydrogen of which is replaceable by an alkyl group, and it is the compound in which the substitution is effected by a phenyl group that is now put forward under the name "orexin."



Dihydrochinazolin.



Phenylhydrochinazolin or orexin.

In practice this compound is manufactured by heating the sodium compound of formamidid with the cor-

responding quantity of o-nitrobenzylchloride, and after purification of the resulting o-nitrobenzylformamidid reducing it to phenylidihydrochinazolin by means of zinc dust in acetic solution. The hydrochloride of this base—orexin hydrochloride—with which the clinical experiments appear to have been made, is stated to be produced in needles containing two equivalents of water of crystallization, which is gradually given off in an exsiccator, the crystals becoming efflorescent: the melting point of the hydrated crystals is 80° C., that of the anhydrous 221°. When laid upon the tongue the compound tastes slightly bitter and leaves an intense burning sensation; it also irritates powerfully the mucous membrane of the nose. In ether it is insoluble, but it is readily soluble in hot water and in alcohol, and for this reason the hydrochloride is preferable in dispensing to the free base, which is almost insoluble in water. From an aqueous solution of the hydrochloride the base is separated by alkalies as an oily precipitate that afterward crystallizes. Orexin hydrochloride is reported to have been used by Prof. Penzoldt in thirty-six clinical cases, in most of which appetite is said to have been induced and the digestion stimulated. In the case of healthy persons the appetite is stated to increase immediately after the first dose, but with most patients the improvement is manifest only after some days. The formula recommended for administration is 2 grammes of orexin hydrochloride made up with extract of gentian and althea powder into twenty pills, gelatin coated, three to five of which are to be taken once or twice daily with a large glassful of meat broth, a considerable quantity of liquid being required on account of the pungent properties of the compound.—*Pharm. Jour.*

LIQUID MASSES.—Herr W. Spring has found that the free surface of a liquid is chemically more active than its internal mass. To show this, he puts into dilute hydrochloric acid a slab of marble slightly thickened at its upper end, so as to form a resting place for bubbles. Where the bubbles gather, the marble is very rapidly eaten through. So also on blowing air on any spot, and so on putting a slab partly within and partly outside the liquid.

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