ing how the auriferous quartz reefs and other rocks which we look upon as the home of the gold became impregnated.

Sir Roderick Murchison, from his observations in the Ural Mountains, originally held that non-alluvial gold was only found in Paleozoic rocks, and principally in his Lower Silurian; but he believed it was not introduced into these rocks until shortly before the Drift period. Subsequently he was led to modify these views to a certain extent, and to admit that secondary and tertiary strata, when penetrated by igneous rocks or impregnated by mineral veins, might also contain gold.

More recent observations show that gold may be found in rocks of any age in metamorphic strata; but all the evidence seems to support Murchison's next contention, viz., that gold is of igneous origin.

There is probably no more instructive area to illustrate this than Southern India, where the distribution of gold has been carefully worked out by Mr. R. B. Foote, of the Geological Survey of India. Almost the whole of this part of India is made of crystalline and metamorphic rocks; and in it there are a large number of gold fields, more or less rich. A closer examination of the country shows that we have here a large mass of gneissic and granitoid rock which is crossed by a number of bands of schist, lava flows, hematite beds and conglomerates. Mr. Foote has shown that these bands belong to a system which is distinct from and newer than the gneiss, and to this system he has given the name of Dharwar. He has shown also that all the gold fields of Southern India, with the possible exception of the Wynad, lie within these Dharwar bands.

As usual, the gold is found principally in quartz reefs; and it is a remarkable fact that though quartz reefs are by no means uncommon in the gneiss, as well as in the Dharwar beds, yet those in the gneiss are never auriferous. It is clear, therefore, that the gold cannot have been introduced into the reefs from below, for in that case there would be no difference in that respect between the reefs in the gneiss and the reefs in the Dharwar.

Only one other possible conclusion remains, viz., that the gold originally lay in the Dharwar rocks themselves, and that it has since, by some process of segregation, been gathered together in the quartz reefs.

It has already been stated that lava flows occur among the Dharwar rocks; and my own observations have led me to believe that many of the schists also are lava flows. In fact a very large part, if not the greater part, of the system appears to be of volcanic origin.

It may be concluded, therefore, that the gold which we now find in the auriferous reefs of Southern India was derived from the rocks of the Dharwar system; and that it was originally brought up from the depths of the earth by the lava flows which form so large a part of that system. — *Science*.

A SENSITIVE SPHEROMETER.

By A. A. COMMON.

THE ordinary spherometer has three arms carrying three fixed points, with a point moved by a screw in the center. This form is an improvement on the original spherometer invented by Andrew Ross, and for which the Society of Arts gave him a silver medal in 1841.

A description of Ross' instrument is given by Holtzapfel, vol. iii., p. 1271, of his work on "Turning and Mechanical Manipulation," extracted from vol.

liii. of the Transactions of the Society of Arts. This instrument could measure to $\frac{1}{1000}$ of an inch, and by estimation half this amount. An ordinary spherometer, with a screw of $\frac{1}{100}$ of an inch pitch and head divided to hundredths, will measure to $\frac{1}{10000}$ of an inch.

I pointed out in vol. i., page 145, of the Memoirs of the Royal Astronomical Society that the sensitiveness of the ordinary spherometer was much increased by placing the screw, not in the center, but in one of the arms in the place of one of the fixed points; this at once increased the sensitiveness of the screw in proportion to the distance of the screw from the nearest fixed point, and this fixed point from a line joining the other two fixed points.

The improvement I wish to bring before those interested in spherometers by this note is the extension of this principle, for by carrying the middle point much nearer the line joining the other two, a proportionate increase of sensitiveness is obtained.

In the case of an instrument I have made on this plan I have increased the sensitiveness thirty times, the distance from the middle point to the screw being three inches, and the distance of the point from the line of the other two being $\frac{1}{10}$ of an inch; with a screw of one hundred threads to the inch and a head divided to hundredths the ordinary form of

instrument will read to $\frac{1}{10000}$, but on the plan I give the same screw will measure $\frac{1}{300000}$ of an inch.

There is an additional advantage in this form, that the curvature of a part nearly in a line is measured, so that cross measures can be taken.

The form of the instrument is not symmetrical, and it requires to be balanced, so that when the screw is raised it will be possible to estimate the frictional contact of the outside points when the middle one is taking the weight. This balancing is easily done by adding a handle to the part opposite the arm carrying the screw; in practice it is found that this handle is of the greatest value in keeping the heat of the hand from the instrument, as even with the ordinary instrument, holding it for a short time in the hand alters the readings materially.

It is of great advantage to have on the arms carrying the two outer pins two pieces of wood or ivory projecting not quite as much as the measuring points, so that by tilting the instrument up these two pieces come first into contact with the surface to be measured, then by gradually raising the handle the points are brought gently into contact. The figure is a plan of this spherometer and shows the position of the three fixed points, P P P, with reference to the measuring screw, S, and the position of the balancing handle, H, with reference to the unsymmetrical arm carrying the measuring screw; X X are the projecting pieces already mentioned.

The movement of the screw being so large for a slight curvature, this instrument is more particularly useful for measuring the slight curvatures of so-called plane mirrors, for which indeed it was designed. To make it available for measuring differences between parts of a curved surface of considerable curvature, the middle pin should be a screw capable of movement to and clamping in a position that will allow the measuring screw to work. — *Nature*.

A MICROSCOPICAL AND ANALYTICAL STUDY OF COCA LEAVES.*

By ALFRED R. L. DOHME, A.B., Ph.D.

Historical.—This cultivated, delicate, but rather ornamental South American perennial has been known and its tonic and invigorating properties made use of since the year 1499, although we learn from the graves and inscriptions of the tombs of the Incas of Peru that the plant had been used as a food stuff and article of luxury much earlier. It was dedicated by the old Peruvians to the sun, and was also used considerably at the time as an article of exchange, taking the place of money. The natives were accustomed to chew it much as tobacco is chewed by the people of this country. This was carried to such an excess that the Vice-King Don Francisco Toledo in 1570 had laws passed prohibiting its use. This was considered rather a harsh measure, as its use enabled the persons chewing it to undergo continuous hardships and perform hard labor without the desire for or necessity of partaking of any food—quite a saving for an economically inclined man, besides the pleasant sensations described as accompanying its use. When the natives intend using the leaves for chewing they prepare them in an especial way, and somewhat as the Chinese prepare their opium preliminary to smoking it. In some parts of Peru the leaves are dried, mixed with ashes, lime and powdered calcium carbonate, and then moulded into small sticks resembling a small stump of a lead pencil.

Descriptive.—*Erythroxylon coca*, Lamarek, is a bush growing to the height of about six feet, and well filled with leaves and blossoms. It flourishes and thrives best on the damp slopes of mountains about 2,000–5,000 feet above the sea level, in a mild warm climate at about 16° 2' to 16° 20' latitude, south. The province La Paz on the slopes of the Andes in Bolivia produces about the largest crops of any in South America. The plant seldom if ever is found growing wild, and is cultivated to such an extent that the annual crop now reaches the enormous figures of about eighty to one hundred million pounds. Most of it is

read with much interest by the professor, and at the instigation of the latter, the writer undertook an investigation of the coca leaves of the laboratory collection. Unfortunately, only one variety was found and no comparisons could be made. The matter was dropped there, although the writer made some sketches of the drawings of the leaf, stem and the flowers of both varieties given by Dr. Burck in his article. He called the two varieties raised in Java respectively *Erythroxylon Bolivianum* and *Erythroxylon Spruceanum*. As far as he could discover, the writer has not found any notice of Dr. Burck's article in any of our leading pharmaceutical journals. While passing through the establishment of Messrs. C. F. Boehringer & Soehne at Waldhof, near Mannheim, the writer asked Dr. Engelhorn, the head of the firm, if he had heard of Dr. Burck's work, to which he replied that he had not, but would like to procure a copy if possible, as it would probably be of some use to him. Having recently had occasion to assay a number of samples of coca leaves, the writer decided to investigate the matter microscopically and analytically, and see if some interesting data could not be obtained. As is well known, there are two varieties of coca leaves that come into this country—named after two cities of Peru where they in all probability are either grown or whence they are shipped. The varieties are "Truxillo" and "Huanuco" coca leaves, varieties that are distinguished usually by their difference in appearance. The "Huanuco" leaves are usually of a dark green color and a thick leathery consistency, while the "Truxillo" leaves are of a light green color and a fragile brittle thin consistency. The "Huanuco" leaves derive their name from the city of Huanuco, lying between the Marañon and Hualloga rivers on the slopes of the Andes mountains, in the central part of Peru, while the "Truxillo" (properly Trujillo) leaves are named after the port of Trujillo in the northern part of Peru. While this commercial, i. e., macroscopic, mode of distinguishing the leaves is not absolutely correct, it answers the purpose in most cases. The "Huanuco" leaves correspond to Dr. Burck's *Erythroxylon Bolivianum* and the "Truxillo" leaves to his *Erythroxylon Spruceanum*.

Assay.—Samples of both varieties of leaves were ground to a No. 30 powder and subjected to assay by the following method:

Ten grammes of the powdered leaves were placed in a 200 c. c. Florence flask and macerated for twenty-four hours, shaking at regular intervals, with a mixture consisting of 70 c. c. of benzene, 25 c. c. of ether and 5 c. c. of a mixture of concentrated ammonia 1 part, absolute alcohol 9 parts (100 c. c. in all). After standing thus for twenty-four hours 50 c. c. were filtered off and shaken in globular separators, with successive portions of 10 c. c. of water and 2 c. c. of a 5 per cent. solution of sulphuric acid, until a drop of the latter gave no cloudiness upon treatment with a solution of mercurio-potassium iodide. The acid solutions were combined in one separator and treated with about 15 c. c. of a benzene-ether mixture to remove all the coloring matter, etc., taken up by the acid water. They were then made alkaline with ammonia and treated with two successive portions of 20 c. c. of ether, the latter being drawn off into a tared beaker. In order to remove the ether (and with it the cocaine) that had been dissolved by the water, the latter was treated with 20 c. c. of chloroform, which readily removes the last traces of cocaine from the alkaline liquid.

The chloroform was then drawn off into the tared beaker containing the ether extracts and all evaporated, and finally heated to constant weight at 100° C. and weighed. This gave the gravimetric result. The residues were then dissolved in decinormal hydrochloric acid by the aid of gentle heat, and the excess of the acid titrated with centinormal alkali, using a decoction of Brazil wood as an indicator. This gave the volumetric result. As has been clearly demonstrated in another paper presented to this association,† the only known reliable method of assaying at present is just this last mentioned method of titration by means of volumetric acid solution. The results follow:

	Sample A.	Sample B.	Sample C.
Huanuco leaves‡ (Erythrox. Bolivianum).....	Gravimetric, 0.87 per cent. Volumetric, 0.61 per cent.	Gravimetric, 1.75 per cent. Volumetric, 0.39 per cent.	Gravimetric, 0.746 per cent. Volumetric, 0.56 per cent.
Truxillo leaves‡ (Erythrox. Spruceanum).....	Gravimetric, 0.79 per cent. Volumetric, 0.18 per cent.	Gravimetric, 0.606 per cent. Volumetric, 0.065 per cent.	Gravimetric, 5.75 per cent. Volumetric, 0.063 per cent.

shipped from the ports of Arica, Callao, Mollendo and Trujillo, although a large percentage remains at home for home consumption. The plant is grown from seed and needs no especial care. After the third year it can be stripped of its leaves, in part at least, thrice annually. The leaves are easily dried, being comparatively poor in juice, and pressed into packages called "cestos," weighing about thirty pounds, by means of banana leaves and coarse linen, and three of such "cestos" are then tied together to form a "tambor," this being as much as one pack horse can carry. The culture of coca leaves has been tried in other countries, but with questionable results, except, perhaps, on the island of Java, where it seems the plant finds surroundings suitable to its mode of life and habits, so that a considerable quantity of coca leaves is shipped to Amsterdam from Batavia. Thence they make their way to the southern part of the Rhine countries of Germany, there to be made to yield to the manipulations of the German chemist the beautiful crystalline alkaloid cocaine.

While a student in the University of Strassburg, Professor Fluckiger one day brought to the writer's notice a pamphlet which had just arrived from the island of Java. It was written by a local Dutch chemist, of the name of Dr. Burck, at Tysmanian near Batavia, and was entitled "Opmerding over de onder den Naam van Erythroxylon Coca in Ned. Indie gecultiverde Gewassen." It contained some investigations upon the microscopic structure of these leaves, distinguishing two varieties and connecting these with the yield of cocaine obtained by assay. It was

From these results we see that Huanuco leaves are better than Truxillo leaves as far as their yield of cocaine is concerned; for although the gravimetric results do not show such a great difference, the volumetric results do. This is proof positive that by the method used, being about the best method known to the writer, the gravimetric results for coca leaves are almost absolutely unreliable.

Microscopical Examination.—If several good sized, sound and well cured Huanuco and Truxillo leaves are soaked in water for several hours and thin cross sections of them, cut so as to include the midrib, made by means of a sharp flat ground razor or a microtome, we are in a position to examine them under the microscope and see if we have a ready means of distinguishing the Truxillo from the Huanuco leaves microscopically. As has already been pointed out,§ it is essential to have the sections cut very thin, in fact so thin that they appear transparent, even to the naked eye.

The distinctive differences to be noted are the apex of the midrib in the case of the Huanuco leaves and its absence in the case of the Truxillo leaves; furthermore, the spread-out and almost flat position of the woody fibers and ducts in the case of the Huanuco

*The experience of the writer has been that a globular separator, drawn to a tube about an inch long between the globe and the stop-cock, will enable the operator to shake the enclosed liquids more readily and advantageously, and with less chance of forming an emulsion, than any other separator he has used.

†Caspary and Dohme—"The Value of Titration with Volumetric Acid Solution as a Means of Assaying Alkaloidal Drugs and Galenical Preparations."

‡These leaves were obtained from different parties to insure their being from different lots, each party sending samples of both kinds.

§Dohme—"The Practical Use of the Microscope in Pharmacy"—Proceedings Amer. Pharm. Assoc., 1892, page 244.

leaves and their more circular and condensed position in the case of the Truxillo leaves. Otherwise there is little difference to be noted. The leaves hence that show the apex and have their woody fibers and ducts spread out rather flat across the section are those that yield the most cocaine, and are hence the most valuable.

CANADIAN POTASH.*

By T. D. REED, M.D., Professor of Materia Medica, Montreal College of Pharmacy.

THE manufacture of "Pots" and "Pearls" in Canada has greatly fallen off in recent years. The competition of the mineral or German chloride has much debased the price, thus rendering the manufacture from wood ashes little profitable. The consumption of unleached ashes for agricultural purposes has also had its effect.

Potash is still, however, an important article of export, as is illustrated by the fact that nearly two millions of pounds weight of "Pots" and "Pearls" (1,800,000 lb.) passed under observation in the government inspection office at Montreal in 1891, and a million and a half (1,409,200) in 1892. The records of the inspection office extend over half a century, and during that time the year of greatest output was 1850, when twenty-seven millions of pounds were exported.

It is stated in Roscoe & Schorlemmer that at the time of the Vienna Exposition the record of the world's production of potash alkali from wood ashes for 1870 was 20,000,000 kilos. If these figures are correct, Canadian potash accounted for one-fourth—10,000,000 pounds.

The writer paid a visit recently to one of the oldest factories in the province, situated in St. Sauveur, a suburb of Quebec. Here potash has been made for over thirty years. A light wood building is divided into two compartments; in one the year's stock of wood ashes, collected in the winter, is stored; the other contains the percolators and furnace. The percolators are wooden cylindrical vessels, like immense hogsheads. The furnace is built of stone, and contains embedded in it three potash "kettles." These are hemispherical pots of cast iron, thirty-seven inches in diameter. They are arranged in line from the front to the back, so as to utilize the heat before its disappearance up the chimney. Nos. 1 and 2 are used for evaporating and melting and No. 3 for heating water for the percolators.

The process for exhausting the ashes is a repercolation; the lye from the first vat is poured into the second, and so on until strong. The liquid poured on top passes through the ashes and then through a layer of slaked lime, on a shelf near the bottom. The fuel was very dry, soft wood, making a fierce blaze.

Two kettles of fused potash were made in four days without working at night. The complete evaporation of the water is manifested by the appearance of the seething contents of the kettle changing to that of a quiet, oily liquid, which soon becomes red hot. This is now ladled into iron moulds to form cakes of about 325 lb. Two cakes make the contents of a cask. The casks are of hard wood, generally oak, the legal size being 32 x 22 inches. Two pounds of dry lime per cask is allowed as a preservative dusting powder.

In a good sample, on breaking the cake, a gray appearance, slightly pink, is seen with a heart of different colors, as white, pink, blue, etc.

For inspection, from a fresh fracture, a portion is broken off and one hundred grains dissolved to be titrated with standard acid for its proportion of alkali estimated as KHO. As there is always some carbonic acid gas evolved, methyl-orange becomes desirable as an indicator. Seventy per cent. and upward, if free from the suspicion of salt, leads to the brand of "first sorts."

During the last two years the range has been from 36 per cent. to 84 per cent. Prof. Lloyd, in an important paper presented to this association at its last annual gathering, reported a sample of American potash testing 91.28 per cent. This is astonishing, as it is stronger than the limit of the U. S. P. or B. P. for fine white stick potash, and much better than the samples reported on by Messrs. Goebel & Patch in 1885. The writer has not met with any stronger than 84 per cent. In addition to real potash, chlorine is especially estimated, as the presence of salt is injurious in soft soap manufacture and other processes. The chlorine is readily found by means of a volumetric solution of silver nitrate with potassium chromate to indicate the completion of its precipitation.

In the products of one manufacturer, whose works were inspected, and in whose *bona fide* confidence was placed, 6 per cent. has been found. As much as 20 per cent. has been met with. In this case adulteration may well be assumed. The workmen handling the potash acquire wonderful skill, by observation alone, and pronounce on the quality with general accuracy without any knowledge of chemistry.

Caustic soda being a possible adulterant, some samples were submitted to Professor Ruttan, of the chemical department of McGill College, for thorough analysis; they were in every case pronounced free from added sodium. The following are some analyses made at McGill of very good and very poor Canadian potashes:

KOH	70.210	53.24	63.06
K ₂ CO ₃	9.194	7.66	22.55
NaCl	1.46	12.90	1.02
K ₂ SO ₄	2.31	11.41	3.73
Insoluble	1.385	1.22	3.899

In the manufacture of pearlash, the lye without lime is evaporated to a condition of black salts, then burnt on the hearth, redissolved, siphoned off bright, evaporated and again burnt, a beautiful granular product with a bluish tint being obtained. This manufacture is in very few hands in Canada; 165,000 lb. passed through the Montreal office in 1892. It was almost uniformly of excellent quality, averaging over 90 per cent. pure.

The difficulty of obtaining good potash and pearlash in the United States, suggested by the tone of Prof.

Lloyd's paper, would be met by applying to Montreal, if the customs rate be not a bar financially. The purchaser of "Pots" and "Pearls" with the Canadian brand "First Sorts," may rely on a good article; the inspection is real, every lot being subjected to chemical tests under the direction of a sworn government officer.

The leached ashes are found to be very valuable in agriculture, probably on account of the unextracted phosphate, and the sale of this helps in a way to make commercially possible the manufacture of potash at the low prices now ruling.

With cheap potash it would seem that a combination with Carolina fossil phosphates could be made which would be very precious for agricultural purposes, returning to Mother Earth some of the most valuable elements of crop stimulation.

The market quotations in Montreal at present would be First Pots, about 4½¢; First Pearls, about 5½¢.

For permission to use the figures and facts on which this paper is based I am indebted to the kindness of E. J. Major, Esq., Ashes Inspector at Montreal.

91 University Street, Montreal, August 10, 1893.

In a discussion that followed the reading of the paper, Prof. Lloyd (Cincinnati) stated that, owing to the decrease in the manufacture and quality of American potash, the users of this material were looking to Canada as the source of their future supply. The Canadian article, he added, was of a high standard, and was remarkably free from adulterants.

A NEW CARBONOMETER.

By W. MOLESWORTH, M.D., Brooklyn, N. Y.

I WISH to invite the attention of the profession briefly to my new carbonometer, believing it to be the only convenient, cheap, and portable device of easy application, for determining the excess of carbonic acid in the atmosphere, in school rooms, sick rooms, hospitals, mines, tenement houses, etc., where absolute accuracy is not required. While the thermometer shows the temperature of a room, the barometer the density of the air, and the hygrometer its moisture, we have had no simple device for testing its pollution as the result

of combustion or respiration. When the actual health of the occupants of any given apartment is taken into consideration, there is no one thing of more importance than the quality of the air itself; and, recognizing the fact that there is no better test of its pollution than the percent. of carbonic acid which it contains, by aid of the carbonometer you can approximate the quantity near enough for ordinary use, and it should be found in every school room or other apartment subject to vitiation of its air.

Each apparatus consists of a glass test tube about five and a half inches long and nine-sixteenths of an inch in diameter, together with a smaller tube about six inches long, contracted about one inch from either end, with a valvular rubber bulb and tube to attach; also a rubber ring to fix its depth in the test tube, a wooden and wire stand for supporting it, with a small bottle each of lime water and vinegar, and a little brush for cleaning the test tube.

Fill the test tube for about one inch, up to the horizontal line, with a perfectly clear saturated solution of lime water; take the smaller tube with bulb attached, adjust the rubber ring so that it will hold the tube about three-eighths of an inch from the bottom of the test tube; gently compress the rubber bulb till all the air is expelled and then allow it to fill again with moderate rapidity, and so continue as often as desired. If, after filling and discharging the bulb six or eight times, the opacity of the lime water obscures the black spot on the base of the stand, the air is absolutely unfit to inhale; and if, after filling the bulb fifteen to twenty times, the black spot is obscured, the observer looking downward from the top of the test tube through the lime water, the air is unfit for continuous respiration. In good air the spot ought not to be obscured in thirty or forty fillings of the bulb, and in pure air not at all. This instrument should be used in daylight, and the test tube washed out with the brush or otherwise after each observation; if incrustations of carbonate of lime form on the tube, remove with a little vinegar, after which wash thoroughly with pure water and wipe dry.

To obtain an idea of its workings, fill and discharge the bulb eight or ten times with the exhalation from your own lungs, and observe its action on the lime water.—*Medical Record*.

THE PRODUCTION OF OXYGEN FROM THE AIR.

THE separation of oxygen from the nitrogen of the air has been practically effected by two processes, both of which depend upon (1) the formation of higher oxides of certain metals and (2) the elimination of the oxygen from the higher oxides by the application of high temperatures or of superheated steam. It is well known, for example, that most of the oxygen used in London for limelight purposes, including, we should add, inhalation experiments, is produced directly from the air by means of Brin's expedient, which consists in exposing ordinary heated baryta (BaO) to air that has been freed from carbonic acid. The peroxide of barium (BaO₂) which is thus formed readily yields oxygen on the application of a higher temperature, the reduced oxide (BaO), which may be used again and again, remaining in the retort. Another method of obtaining oxygen from the air consists in heating manganate of potassium (KMnO₄) in a current of steam, when oxygen is evolved and caustic potash and the lower oxides of manganese are formed. The caustic potash and the reduced manganese are treated again in contact with air, when manganate due to absorption of the oxygen of the air is reformed. So this process, like the last, is practically continuous. More recently a process which appears to offer certain advantages over others in vogue, though its action is more complex, has been studied, with the view of establishing it on a commercial scale, by G. Kassner, a German chemist. This chemist employs, in the form of spongy porous masses, calcium plumbate (Ca₂PbO₄), a compound of lime with peroxide of lead, which being first exposed to moist furnace gases absorbs carbonic acid and is converted into a mixture of carbonate of lime and free peroxide of lead. Then, on heating this mixture in a retort, oxygen, at first in a state of purity, is evolved, but as the temperature rises it is contaminated, more or less, by carbonic acid, which is readily removed, however, by passing the gas over a column of the fresh plumbate. Toward the end of the operation, which is assisted by means of a current of superheated steam, carbonic acid gas in a state of purity is given off. The residue in the retort, consisting of an intimate mixture of lime and litharge (PbO), is reconverted into plumbate by simply driving a current of air through the heated mixture in the retort. Thus the plumbate can be used over and over again in the same way that baryta or manganate is used in the processes previously described. The purity of oxygen is a matter of considerable moment, of course, when the gas is intended for purposes of inhalation. In industrial and other applications, too, it is necessary to employ fairly pure oxygen if good results are desired. Judging from recent literature on the subject of oxygen in its application in the arts and industries, there appears to be an increasing demand for a process which will provide a pure gas at a reasonably cheap rate. Of the individual processes described, however, experience must be left to decide which is best suited for the purposes in view. Already oxygen has been suggested as an effective agent in the purification of sewage, but as yet no practical success seems to have attended the efforts of the enterprising investigators.—*The Lancet*.

SODIUM.

SODIUM resembles potassium in several respects, but it is lighter and harder, and the lustrous silvery white surface it presents when newly cut assumes a pinkish tinge before acquiring a gray hue. Potassium turns to a bluish-gray. Sodium is compressible between the fingers, like wax, but it ought to be handled under the surface of kerosene oil, as it takes fire easily in combination with moisture, even with perspiration, and the attendant burns are of the worst kind. It can be easily divided with a meat chopping knife. It retains its plasticity at the freezing point of water, which potassium does not.

Sodium is so light a metal that it requires about 28 cubic inches to make one pound; so that if cast, as is usual, into ingots about three-quarters of an inch square and six inches long, at least eight of these would be required to make a pound. These ingots are usually packed in oil in glass-stoppered bottles or sealed metallic cylinders. Its specific gravity at its boiling point (900° F.) is 0.744, at its melting point (200°) 0.929, and at 32° from 0.9348 to 0.9766. Its expansion with heat is great, therefore, for a metal—about four times that of quicksilver—and it ought to be useful for thermometers to register temperatures above 600°, where mercury becomes unreliable. As a conductor of heat and electricity sodium is surpassed only by gold, silver, and copper.

The vapor of sodium has a purplish tint. When masses of sodium are thrust under the surface of water the explosions that follow are nearly, if not quite, equal in violence to those of potassium, but when placed on the surface of water it decomposes that liquid with violence. Still, unless the water is hot, it does not take fire. If, however, a small quantity of water is brought in contact with it on a surface which is not a good conductor of heat, as a piece of wood or charcoal, for example, it takes fire and burns with great energy. It needs to be handled with great caution.

Sodium is found in nature chiefly in the form of common salt, its chloride. It is exceedingly abundant, and though it now sells for 50 or 75 cents a pound, it could be produced much more cheaply if there were any use found for it. Davy discovered it in 1807 by electrolysis of caustic soda with a powerful voltaic battery. Carbon also decomposes that salt at high temperature and is now practically the only agent used in obtaining sodium. Gay-Lussac and Thenard found that iron would also perform this work, and Castner, an American inventor, devised a method of using iron and carbon together, but this is not likely to supersede carbon alone.

Sodium and potassium when alloyed together present the extraordinary phenomenon of a permanently liquid metal, like quicksilver. This is in accordance with a law which is very general—namely, that alloys melt at lower temperatures than the mean melting point of their component metals. This law is of high practical importance. It has a general application to other metallic alloys (the "fusible alloys" being exam-

* Paper presented at the forty-first annual meeting of American Pharmaceutical Association, held in Art Gallery, Chicago, August 15, 1893, and read by J. E. Morrison, Montreal, in absence of the author.