feeling of justice for the animal. He quickly inspires his horses with respect and confidence—for he rarely uses the whip or force—and seldom or never with fear. Therein lies the secret of his great success.

The result of his breaking and training is shown in a pleasing manner in a feat that reminds one of the fabulous Hungarian rider and constituted a great attraction as one of the "Hungarian Pictures" at the recent Millennium Exposition. We refer to the feat illustrated in the accompanying engraving, in which the Hungarian Hengst Tiger is ridden across the track by Fraulein Motzelt on a moving roller 79 inches in diameter. By a light, elegant spring the horse reaches the top of the roller, which is provided with slats an inch apart and running parallel with the long axis of the roller, so as to give him a good hold and to facilitate the rolling movement.

Once on the roller Hengst rolls it along by stepping forward slowly, until it reaches the edge of the track, then he jumps down, rises on his hind legs, and in this position crosses the track and leaves the theater of his triumphs, his rider clinging to him as if cast in the saddle. During the ride on the moving roller the horse and rider present a fine appearance; the noble beast is so quiet that he reminds one of a monumental statue, and yet his is a most vivacious nature, almost wild. It is wonderful that by pure force of will his master has made him perform one of the most difficult tasks that could be set for any horse, even one of the quietest disposition.—*Illustrirte Zeitung.*

PREPARATION AND PROPERTIES OF URANIUM.

By HENRI MOISSAN, in *Comptes Rendus*.

IN a paper published on February 20, 1893, we have established that uranium oxide, hitherto regarded as not reducible by carbon, can yield metallic uranium in presence of this substance at the high temperature of my electric furnace. We have since demonstrated the existence of a definite crystalline compound of uranium and carbon, C_3U_2 .

We shall now give a more complete study of this metal.

It is known that metallic uranium was first prepared by Peligot by reducing uranium chloride with potassium in a platinum crucible. By this procedure we obtain a gray powder, in the midst of which are found some small metallic globules.

Different chemists have slightly modified this operation, and in 1886 Zimmermann resumed the study of uranium, and obtained the metal by reducing uranium chloride with sodium. The isolated metallic globules in this preparation were few in number. Their fusion was due to the intense heat developed by the action of the alkaline metal upon the chloride.

We have repeated all these experiments. If we operate in a platinum crucible, the uranium is always soiled with this metal. In Zimmermann's preparation the uranium always contains 2 per cent. of iron and a small quantity of sodium.

Moreover, whatever is the method employed, all these uranums in powder contain nitrogen and often oxygen. As we shall demonstrate below, metallic uranium has a strong affinity for gaseous nitrogen, hitherto unknown.

We thought that this action of the alkaline metals might be more advantageously employed by means of a double compound of sodium and uranium.

Preparation of Double Uranium and Sodium Chloride, $UCl_4 \cdot 2NaCl$.—When we pass a current of vapor of uranium chloride over sodium chloride we obtain a double chloride, which on cooling congeals to a crystalline mass of an apple green color, melting at 390° , fusible about 390° , soluble in cold water, and dissociated by alcohol.

This preparation is very easily made in a tube of Bohemian glass, forming at one end uranium chloride by the action of chlorine upon uranium carbide, and causing this chloride to pass over fragments of sodium chloride placed at the other end and heated to dull redness. The solid alkaline chloride begins to be colored, seizing all the vapor of uranium chloride, and then the mass melts rapidly.

We know that uranium chloride, UCl_4 , is greedy of moisture, fumes in the air, and is not easily manageable. On the contrary, the crystalline double chloride is much less hygroscopic and more stable. If fused, it yields a very stable liquid, which does not apparently give off vapors.

Reduction of this Double Chloride by Alkaline Metals.—The reduction has been effected in a very thick iron cylinder, closed with a screw stopper. It is charged with alternate layers of 300 grms. double chloride and 100 grms. sodium recently cut.

The apparatus being closed, it is placed in a very brisk wood fire, when it is heated for twenty-five minutes. The heat disengaged by the reaction is so intense as to raise the block of iron to a cherry red heat in a few instants. When cold, the cylinder is opened, and the powdery contents treated at first with alcohol at 96° to remove the excess of sodium, then rapidly washed with water which has been boiled and allowed to cool, then exhausted with alcohol and lastly with ether.

Preparation of Uranium in the Electric Furnace.—We have indicated in a former paper on uranium carbide how the industrial uranium carbide must be purified. The uranium having been brought to the state of green oxide (U_3O_8), is intimately mixed with sugar charcoal in fine powder in the following proportions:

Uranium oxide. . . . . 500 grms.
Sugar charcoal . . . . . 40 "

About 500 grms. of this mixture are placed in a coke crucible and submitted in the electric furnace for seven to eight minutes to a current of 800 amperes and 45 volts. We thus obtain a fused ingot of about 350 grms. The metal thus prepared, if the heating has been well conducted, contains very little carbon, and sometimes even not a trace. On the contrary, we may find in it a small quantity of oxide, which then furnishes a "burnt metal," the physical properties of which are notably modified. If the duration of the heat is too long, the metal is readily carbided, and we obtain a cast metal and then a crystallized carbide, C_3U_2 . To avoid the action of nitrogen, it is better to make these experiments in a tube of coke closed at one end, and adopting the arrangement above indicated.

Refining Uranium at the Forge.—When we prepare by the above procedure an uranium containing from

0.1 to 0.5 of carbon, we may refine the exterior of the fragments by heating them for some hours in a crucible lined with green uranium oxide. To realize this experiment we must place the crucible containing the uranium oxide on the metal in the middle of another crucible filled with titaniferous carbon finely pulverized. The neglect of this precaution might produce a yellow metal coated with nitride.

Preparation of Metallic Uranium by Electrolysis.—The double uranium chloride above described is electrolyzed with the greatest ease. It yields at the negative pole a sponge of uranium containing frequently small crystals of this metal. To have regular working it is sufficient to have at the terminals a difference of potential of 8 to 10 volts. We have generally used a current of the density of 50 amperes. The bath is kept in fusion by the thermic action of the current itself.

The electrolysis is effected by means of electrodes of pure charcoal, and the chloride is placed in a cylindrical vessel of porcelain. This vessel is closed by means of a plate of porcelain, giving passage to the two electrodes and to a glass tube bent at a right angle. This tube enables us to introduce above the melted salt a current of hydrogen very dry and very free from nitrogen.

After complete cooling, the contents of the crucible are taken up with ice water, and washed rapidly with alcohol; for uranium, if finely divided, decomposes water at the ordinary temperature.

This uranium is crystalline, and certain parts near the electrode appear even in crystals measuring 1 mm. on the sides.

If we employ an iron electrode, we obtain alloys of iron and uranium of a silvery white, which may be easily filed and which have a very fine grain.

Physical Properties.—When uranium is very pure its color is absolutely white, less bluish than that of iron, though it takes a similar polish. If the metal has a yellow tint, we may always suspect the presence of nitrogen. To its specific gravity we shall return below.

Pure uranium may be easily filed; it does not scratch glass. It may be slightly carbided if heated in a crucible lined with carbon, and may be tempered.

Uranium is not magnetic when quite free from iron. In the electric furnace uranium is much more volatile than iron.

Chemical Properties.—Uranium in fine powder, as prepared by electrolysis, takes fire in fluorine, burns brilliantly, and forms a volatile fluoride of a green color. Chlorine attacks it at the temperature of 180° , and bromine at 210° , both with incandescence. The same reaction is produced in the vapor of iodine about 260° with formation of uranium iodide. All these reactions are complete. The metal obtained by Zimmermann was not attacked by the vapor of iodine, and in a current of chlorine it underwent a limited reaction, leaving in the boat an abundant residue.

Hydrochloric acid gas attacks it with incandescence at a dull red heat, yielding a stable chloride which produces a green solution in water. Hydriodic acid attacks it near a red heat.

Uranium in fine powder burns in pure oxygen at 170° and upward, producing a very dark green oxide. Sulphur reacts about 500° , furnishing a black sulphide which is slowly attacked by hydrochloric acid, yielding hydrogen sulphide. With selenium it combines with incandescence.

As we have remarked above, uranium combines with nitrogen with the greatest ease. Fragments of the metal heated to $1,000^\circ$ in a current of nitrogen became covered with a yellow layer of nitride. Uranium in powder reacts with a gaseous ammonia above dull redness, but without incandescence, producing an escape of hydrogen and leaving a black crystalline powder, which we are now examining.

Pure uranium in very fine powder decomposes water slowly at ordinary temperatures and more rapidly at 100° . This property approaches it to iron, since according to our colleagues Troost and Hautefeuille, reduced iron decomposes water at its boiling point.

Melted uranium in contact with water is covered with a layer of oxide; this action is strikingly accelerated by the presence of carbonic acid.

Analysis.—In all these researches the uranium has been separated and determined in the form of U_3O_8 , and the carbon weighed as carbon dioxide.

Double uranium-sodium chloride yielded on analysis the following figures:

	1.	2.	3.	Theory.
Uranium	47.9	47.7	48.2	48.08
Sodium	—	—	10.10	9.21
Chlorine	42.3	42.4	42.01	42.68
Metallic uranium prepared by sodium gave:				
Uranium	99.40	99.40	99.28	

The specimen always contained traces of the alkaline metal. The metal prepared in the electric furnace contained:

	1.	2.	3.	4.
Uranium	99.121	99.106	98.021	99.520
Carbon	0.168	0.601	1.356	0.005
Slag	0.187	0.204	0.303	0.421

Uranium obtained by electrolysis:

	1.	2.
Uranium	99.27	94.48
Insoluble in nitric acid	0.52	0.27

Conclusions.—Metallic uranium may be easily obtained either by decomposing the double uranium and sodium fluoride with sodium or by the electrolysis of the same compound, or preferably by reducing uranium oxide with carbon in the electric furnace. These three methods yield good results, and for these researches we have had occasion to prepare more than 15 kilos. of metallic uranium.

Uranium may be obtained crystallized; the pure metal has properties approaching those of iron. It can be filed, carbided, tempered, and oxidized in the same manner. Its tendency to combine with oxygen is greater than that of iron; in fine powder it decomposes water slowly in the cold; its reaction with the hydrides is also more energetic than that of iron. It has a more powerful affinity for nitrogen, and without special precautions the product obtained always contains a certain quantity of this element.

This metal when quite free from iron has no action upon the magnetic needle, and in the electric furnace it is much more volatile than iron.—*Comptes Rendus*, cxxii, p. 1088.

SELECTED FORMULÆ.

Salt Water for Aquaria.—A satisfactory imitation of salt water for use in aquaria in which sea fish are to be preserved may be made by dissolving in 18 gallons of pure well or river water 1.25 grammes of sodium chloride, 90 grammes of magnesium sulphate, 22.5 grammes of potassium sulphate and 185 grammes of magnesium chloride. The best results will be obtained if the solution is allowed to stand in the open air in a cool place for, say, two or three weeks. A few sea algae, such as grow on stones on the seashore, should be added. As soon as the glass walls of the container show small microscopic green spots, the water is in a condition to use. It is advisable to add some kind of sea weed, the genus *Ulva* being particularly useful, as they serve to keep the water in a habitable condition.—*American Druggist.*

Paste for Pads.—

Glue	4 pounds
Glycerine	2 "
Linseed oil	$\frac{1}{2}$ "
Sugar	$\frac{1}{4}$ "
Aniline dye	q. s.

The glue is softened by soaking it in a little cold water, then dissolved together with the sugar in the glycerine by aid of heat over a water bath. To this the dye is added, after which the oil is well stirred in. It is used hot. Another composition of a somewhat similar nature is prepared as follows:

Glue	1 pound
Glycerine	4 ounces
Glucose sirup, about	1 "
Tannin	48 grains

Give the compositions an hour or more in which to dry or set before cutting or handling the pads.—*Pharmaceutical Era.*

To Restore Crape.—Black crape may be freshened and made to look almost equal to new if treated in the following way: Lay over the ironing table a piece of black cambric or cloth of any kind, and pin the piece of crape smoothly through to the blanket, stretching it out to its original size. Wring another piece of black cambric out of water and lay it over the crape, patting it down with the palm of the hand. Now take hot flatirons and pass them over the wet cloth, letting them just touch the cloth, but allowing no pressure to come upon the crape. When the cloth has become dry from the heat of the iron remove it, but let the crape remain pinned down until all the moisture has evaporated and it is perfectly dry. The crape will now feel and look like new. A long veil can be renovated in this way, making sure that the part redressed comes under the edge of the wet cloth.—*Lady Charlotte in London.*

Koumyss.—In addition to the formula given in the National Formulary for fermented milk, the following is submitted:

Fresh milk	12 ounces
Water	4 "
Brown sugar	$2\frac{1}{2}$ drachms
Compressed yeast	24 grains
Milk sugar	3 drachms

Dissolve the milk sugar in the water, add to the milk, rub the yeast and brown sugar down in a mortar with a little of the mixture, then strain into the other portion. Strong bottles are very essential, champagne bottles being frequently used, and the corks should fit very tightly; in fact, it is almost necessary to use a bottling machine for the purpose, and once the cork is properly fixed it should be wired down. Many failures have resulted because the corks did not fit properly, the result being that the carbonic gas escaped as formed and left a worthless preparation. It is further necessary to keep the preparation at a moderate temperature, and to insure the article being properly finished, the bottles are to be gently shaken each day for about ten minutes to prevent the clotting of casein. It is as well to take the precaution of rolling a cloth around the bottle during the shaking process, as the amount of gas generated is great, and should the bottle be of thin glass or contain a flaw it may give way. Some few days elapse before the fermentation passes into the acid stage, and when this has taken place the preparation is much thicker. It is now in the proper condition to be used.—*Pharmaceutical Era.*

To Determine the Presence of Alum in Bread.—Von der Planken (Annal de Phar. Lourain) recommends that 10 to 20 grammes of bread be mixed with water to form a paste; to this is added some sodium chloride free from alkali, 10 drops of freshly prepared tincture of Campeachy wood, and 5 grammes of freshly precipitated calcium carbonate. The entire mass is triturated together, and then washed into a beaker, adding water until its volume reaches 100 c. c. On standing, the supernatant fluid will assume a grayish to deep blue color if alum be present, while if the materials are pure, a red violet color is produced.

Preventive Lotion Against Insect Bites.—

Acetic ether	5 parts
Eucalyptol	10 "
Eau de cologne	10 "
Tincture of pyrethrum roseum	60 "

One part diluted with 3 or 6 parts of water, to be used as a lotion.—*Jour. des mal. cutan.*

To Paste Labels on Cork.—The following formulas are from the English Mechanic:

Gum tragacanth	1 ounce
Gum Arabic	4 "

Dissolve in water, 1 pint; strain, and add thymol, 14 grains, suspended in glycerine, 4 ounces; finally add water to make 2 pints.

(2) Rye flour, 4 ounces; water, 1 pint; nitric acid, 1 drachm; carbolic acid, 10 minims; oil of cloves, 10 minims; glycerine, 1 ounce. Mix the flour and water, strain through cheese cloth, and add the nitric acid. Apply heat until suitably thickened, and add the other ingredients when cooling. This paste is suitable for almost any kind of labels, and it will adhere to almost anything.

Stomatal.—This is a dentifrice which, according to the French patent reports, is made by mixing 4 parts of terpinol, 42 of water, 45 of alcohol, 2 of soap, 5 of glycerine, and 2 of aromatics.