

ELECTRO-METALLURGY.

GOLD DEPOSITS.

In the practice of electroplating with gold the bath employed is usually heated, as the deposits obtained in such a bath are more homogeneous, tenacious, and durable, and of a better color, besides which recommendation a greater quantity of the metal may be deposited satisfactorily from it in a given time than from a cold bath.

Owing to the cost of the metal to be deposited very large surfaces are rarely required to be electroplated, and as these baths become worn out and must be replaced by fresh solutions after a short time, they are usually, as a matter of economy and convenience, used in as small a vessel as the circumstances will admit of. These vessels may be of glass, porcelain, or porcelain-enameled iron. The latter serve the purpose admirably (if the enamel is good). They should be heated over the water bath or by means of steam.

The same bath does not answer very well for all metals—either the bath must be modified to suit the metal or the latter must be previously coated with another metal to suit the conditions. Gold deposits are obtained with the greatest facility upon silver or copper, their rich alloys, or other metals coated with them. With these a hot bath (at about 170° F.) and a moderately strong current give good results. With alloys, such as German silver, the best results are obtained with a weak bath, barely warm. Steel and iron, when not coated with copper, require an intense current and a very hot bath. Lead, zinc, tin, antimony, and bismuth alloys of, or containing much of these, are preferably coated with copper before electro-gilding.

HOT BATHS.

For silver, copper, or alloys rich in these:

Distilled water	1 gallon.
Phosphate of soda, cryst.....	9½ ounces.
Bisulphite of soda	1½ "
Cyanide of potassium, pure	½ "
Gold chloride.....	160 grains.

Dissolve in a portion of the water, heated, the phosphate of soda. Dissolve in another portion of the water the bisulphite of soda and cyanide of potassium.

Dissolve the gold chloride in the remaining water, stir the solution slowly into the cold phosphate of soda solution, and finally add the solution of cyanide and bisulphite. The bath, now ready for use, should be colorless.

The cost of this bath is about \$5 a gallon, and the metal can be deposited from it profitably at \$2 per dw. Used at a temperature of from 120° to 175° Fah.

BATH FOR IRON AND STEEL—UNCOATED.

Distilled water	1 gallon.
Phosphate of soda, cryst.....	7½ ounces.
Bisulphite of soda	2 "
Cyanide of potassium, pure.....	¾ drachm.
Gold chloride.....	160 grains.

Dissolve as before. Heat to 175° or 180° Fah. Pass the second metal through the hot potash, then through dilute muriatic acid (acid 1, water 15), brush, and connect at once. Requires a very intense current at first.

The following baths work well with bronze and brass, but are not suited for direct gilding on iron or steel:

Distilled water	1 gallon.
Phosphate of soda, cryst	6½ ounces.
Bisulphite of soda	1½ "
Bicarbonate of potash.....	1 "
Caustic soda.....	1 "
Cyanide of potassium, pure.....	1 "
Gold chloride.....	1 "

Dissolve all together, except the gold chloride, in the hot water; filter, cool, and gradually stir in the gold chloride dissolved in a little water. Heat from 120° to 140° Fah. for use. It requires an intense current.

Distilled water	1 gallon.
Ferrocyanide of potassium.....	5¼ ounces.
Carbonate of potash, pure.....	1½ "
Sal ammoniac.....	1 "
Gold chloride.....	1 "

Dissolve as in the last, boil for half an hour, replace the evaporated water, and the bath is ready for use.

Distilled water.....	1 gallon.
Cyanide of potassium	2½ ounces.
Gold chloride.....	1 "

Dissolve the gold chloride in the water, then add the cyanide, and stir until solution is complete.

Baths of this kind are commonly used, and with little regard to temperature. They are simple in preparation, but are, unfortunately, not very uniform in their working, un-gilding one part while another is gilding, and producing a variety of colors, especially when freshly prepared. They improve by use, however.

COLD ELECTRO GILDING BATH.

Water, distilled.....	1 gallon.
Potassium cyanide, pure.....	3½ ounces.
Gold chloride.....	3½ "

Dissolve the cyanide in a part of the water, then gradually add the gold chloride dissolved in the remainder. Boil for half an hour before using. (Use cold.)

The cold bath is kept in a gutta percha lined, wooden, or (if small) porcelain tank arranged as for brass plating. The anodes are thin plates of laminated gold, wholly suspended in the liquid (while in use) by means of platinum wires, from clean brass rods joined to the copper or carbon pole of the battery, the rods supporting the work being in connection with the zinc. When in proper working order the color of the deposit is yellow. If the deposit becomes black or dark-red, add more cyanide (dissolved in water) to the bath, or use a weaker current.

If the cyanide is in excess the plating will proceed very slowly or not at all; or, as sometimes happens, articles already gilded will lose their gold. In such cases add a little more gold chloride or increase the intensity of the current.

Cold electro-gilding must be done slowly, and requires a good deal of attention to secure good work. The articles must be frequently examined to detect irregular deposits or dark spots (which must be scratch-brushed and returned). It is also frequently necessary to add to or remove an element from the battery, especially when adding or taking work from the bath. With too much intensity of current the deposit is black or red; if too weak those portions opposite the anode only get covered. In coating German silver it is necessary to use a weak bath and a small exposure of anode. The best results with this alloy are obtained when the bath is slightly warmed.

MANAGEMENT OF THE HOT BATH.

The articles should be kept in agitation while in the bath. They should be placed in connection with the battery before or immediately upon entering the bath. A foil or wire of platinum is in many cases preferable to a soluble gold anode when electro-gilding by aid of heat. It suffers no alteration in the liquid, and by its manipulation the color of the deposit may be materially altered. When it is removed so as to expose only a small surface in the bath a pale yellowish deposit may be obtained; when the immersion is greater, a clear yellow; with a still greater exposure, a red gold color. The strength of the hot baths may be maintained by successive additions of gold chloride with a proper proportion of the other salts and water; but it is preferable to wear out the bath entirely and prepare a new one, as it soon becomes contaminated with copper or silver if much of these metals have been gilded in it. In a nearly exhausted bath containing dissolved copper the electro deposit will be what is called "red gold;" if it contains an excess of silver a "green gold" deposit will result. The gold and copper or gold and silver are deposited together as an alloy, the color of which depends upon the relative proportion of the metals, battery strength, etc.

Dead luster gilding is produced by the slow deposition of a considerable quantity of gold, by giving the metallic surface a dead luster before gilding (by means of acids), by first preparing a coating of frosted silver or by depositing the gold upon a heavy copper deposit produced with a weak current in a bath of copper sulphate.

In order to secure a good deposit of gold it is absolutely necessary that the work should be perfectly freed from any trace of oxide, grease, oil, or other impurity. Articles of copper and brass may be cleansed by first immersing them in a strong boiling solution of caustic potash or soda, and, after rinsing, dipping momentarily in nitric acid and immediately rinsing, or scouring with pumice stone moistened with a strong solution of cyanide of potassium in water.

Other metals require a somewhat different treatment, which we will have occasion to refer to in a subsequent article.

The bichromate battery is commonly used in connection with hot electro-gilding baths. See article on nickel-plating, p. 153, No. 10, vol. xliii.

As gold chloride procured in the market cannot always be depended on for purity and strength, it is preferable to purchase the gold and make the chloride. A pure gold chloride may be prepared as follows:

Put coin gold, in small pieces, into a glass flask with about five times its weight of aqua regia (nitric acid 1, hydrochloric acid 3), and heat gently, with small additions of aqua regia if necessary, until the gold is dissolved and the silver remains behind as white chloride. Let it settle, decant the clear solution, wash the residue several times with water, adding the washings to the gold solution. Evaporate off excess of the acids in a porcelain dish over a water bath (nearly to dryness). Dilute with ten parts of water, and gradually add a strong aqueous solution (filtered) of sulphate of iron. Let stand until the dark powder (gold) settles; gently decant the liquid, wash the gold with hot water, and redissolve it in a small quantity of warm aqua regia and evaporate the solution, with constant stirring, to dryness in a porcelain dish over the water bath. One ounce of pure gold equals about 1½ ounce of this chloride.

The Work of the Patent Office in 1880.

The annual report of the Commissioner of Patents for the year ending December 31, 1880, gives the business of the year as follows: Applications for patents for inventions, 21,761; applications for patents for designs, 634; applications for reissues of patents, 617; total, 23,012. Patents issued, 13,441; patents reissued, 506; patents expired, 3,781; trademarks and labels registered, 533.

Of the 13,441 patents issued during the year, 12,655 were to citizens of the United States, and 786 to foreigners.

There was received during the year for patents, copies of records or drawings, and from other sources, an aggregate of \$749,685.32. The total amount expended was \$538,865.17, leaving a balance of \$210,820.15. On January 1, 1880, there remained \$1,420,806.56 to the credit of the Patent Fund, which, added to the surplus of 1880, makes the amount to the credit of the Patent Fund on January 1, 1881, \$1,631,626.71.

Our Export of Breadstuffs.

The official report of the exports of breadstuffs in 1880 shows the largest movement ever recorded, both as to quantity and as to value, except during the fiscal year which em-

braced the first six months of 1880. Reducing flour and meal to wheat and corn, at the approximate rate of five bushels to the barrel, the quantities exported for the last two years may be stated thus:

	Quantity.		Average Price.	
	1880.	1879.	1880.	1879.
Flour, barrels	6,545,920	5,885,831	\$5.82	\$5.53
Meal, barrels	384,177	340,969	2.93	2.60
Wheat, bushels	134,701,146	137,975,715	1.20	1.16
Corn, bushels	105,717,315	83,144,845	55	49
Rye, bushels	2,346,995	4,445,030	92	69
Barley, bushels.....	1,246,640	1,103,514	65	61
Oats, bushels	544,294	1,049,934	45	34
Wheat and flour, bush'ls	167,430,746	167,404,870		
Corn and meal, bushels.	107,638,100	84,849,690		
All grain, bushels	279,206,775	258,852,038		

Correspondence.

The Sun Dogs of Colorado.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN, dated January 22, appears a letter from Jerseyville, Ill., written by F. S. Davenport, in which, after describing the remarkable sun dog phenomena of December 30, 1880, he inquires if any one had ever seen the like before. Colorado was almost wild over such a phenomena, December 23, 1876. In this case it began at sunrise. The thermometer indicated all the way from ten to twenty-two degrees below zero. The atmosphere was suffused with a myriad of crystalline particles. The horizontal rays of which Mr. Davenport speaks encircled the entire horizon, and had in it four additional sun dogs the greater part of the day, and at times eight. Instead of being one circle around the sun, we had two, the inner one bright, the outer one fainter. The upper arc of the outer one touched the arc of the brilliant prismatic crescent in the zenith. This crescent was brighter at that time than the sun, and could be looked at only a short time on account of its extreme brilliancy. The sky within the circle which the crescent would have formed, if complete, was a deep blue and very beautiful. Full descriptions were given in all of the Colorado papers, while the Denver Tribune gave a cut representing it partially.

The spectacle lasted until three o'clock, though it was brightest at about eleven. An additional halo, somewhat like a rainbow, was visible in the western heavens at about sunset.

A similar phenomenon, though not near so bright, was witnessed some time last December.

Boulder, Col.

OTTO H. WANGELIN.

Corundum Localities of Georgia.

The corundum outcrops of Georgia are widely separate. In the northwest part of the State, in Towns County, and southwest of the corundum locality in Clay County, North Carolina, is an outcropping of corundum, a portion of which is of reddish color. Here a good amount of work has been done, with what success I am unable to say. The matrix of this corundum is smaragdite, called by some distinguished mineralogists kokscharoffite. The composition of the two are similar, except that smaragdite contains the oxide of chromium, which is probably the coloring matter of the corundum. The matrix of corundum is usually some one of the varieties of chlorite; that of the precious gems, the ruby, sapphire, etc., is ripidolite. I doubt whether the colored varieties can be found only in connection with chrome. Southwest of this are several outcrops of corundum extending nearly to the line of Alabama; also one or two in the eastern part of the State, none of which are at present mined.

The only outcrops of corundum in Alabama are found lying between the waters of the Coosa and Tallapoosa rivers in Tallapoosa County. These mines are worked by the Hampden Emery Company, of Chester, Mass. The annual yield is small.

Throughout the United States, as yet, no localities have been discovered with the corundum disseminated through the spinel, making emery like that of Naxos and Turkey.

Geologically considered the corundum seems to occur in belts associated with the magnesian minerals, and is usually found in the outcrops of serpentine and crysolite. From Dudleyville, in Alabama, it extends northeast through the northwest part of Georgia into the mountains of North Carolina, where the largest development occurs. Passing through the Blue Ridge it continues in a northeastern course through the State, similar to the gold and other metalliferous and mineral belts. There is another belt passing through the eastern part of Georgia into South Carolina.

Judging from the present development of corundum, no sufficient quantity can be had to take the place of emery.

(MRS.) H. A. BURDICK.

THE Victorian Review, the leading monthly of Australia, published at Melbourne, and one that compares favorably with our best home magazines, after mentioning a number of illustrated industrial subjects which had attracted the editor's special attention, concludes as follows:

"In fact, nothing rare, or curious, or useful, in the worlds of nature or of industry, seems to escape the conductors of the SCIENTIFIC AMERICAN."