

American Electro-platers' Society

(An Educational Society)



Chartered 1909

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QUARTERLY REVIEW

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Editorial

PASS YOUR KNOWLEDGE ALONG

THE members of this Society are not getting all the good that is possible out of the QUARTERLY REVIEW, and more interest should be taken in the articles published. Since the beginning there has been no criticism offered on any of the papers presented. This, while flattering to the authors, does not prove that the matter given was perfect. There must have been some difference of opinion as to the merits of the formula given or the process described. To read and know that some improvement could be made or any error of statement corrected, and then not to communicate it to the Editor for publication in the next issue, is not in accordance with the spirit and object of the Society. The members should consider it their duty to bring out any new phase of a subject. The authors would appreciate just criticism, and take pride in defending their position. This is done, as a rule, with papers presented at a meeting, and should be in the QUARTERLY REVIEW. The report of the discussion should accompany any paper that has been read before a meeting before being published. Often more can be learned from the discussion than from the paper itself. The several branches have a member on the Editorial Staff, and either he or the librarian could note the main points of the discussion and prepare them for publication. A better way, and one which would do more toward the "disseminating of knowledge," would be for each branch to engage a stenographer and have him report the discussions.

Even in one year's time what a valuable mass of information of real practical value could be compiled. The volumes of the QUARTERLY REVIEW would be priceless to the members, and instead of being the vehicle to convey the thoughts of the few who are willing

to write their experiences, it would contain the experience of the most humble member, and often they are the ones who possess the little "trick" that counts for so much in the plating room.

The Society is progressing and the membership is rapidly increasing. There is an earnest desire to gain definite knowledge of the chemistry of electro-plating being manifested. One every hand we see evidences of this, and each Bulletin contains some note of the progress of some branch in that direction. Four years ago nothing was being done toward this end; today every branch is making an effort to establish a course in practical work and a laboratory for investigation. Toronto is leading the way with a fully equipped laboratory, meeting twice a week for instruction. Rochester meets in the University of Rochester; Milwaukee in the Marquette University; Philadelphia has demonstrations in the plant of one of its members; Indianapolis has an electro-chemist to instruct them; Newark is making every effort to obtain funds to equip a laboratory, with much promise for success; New York, Chicago, Dayton, St. Louis, Cincinnati, Buffalo and Detroit have definite plans for the furtherance of the knowledge of chemistry among their members. Another year, and that is a short time, we venture to say that every branch will possess a research laboratory.

We must not stop there; the knowledge gained, the results of investigations should not be just for the members of the one branch. That is not the spirit of education. The opportunity may be yours, but how about the fellow member who could not attend the meeting, must he be denied what knowledge you were fortunate enough to obtain? He has the interests of the Society at heart as well as you, and if approached by a member to lend a helping hand, would feel complimented to think that the opportunity came to pass some of his experience along. Pass your experience along. What you may have accomplished may not seem much to you, but there may be one member who has worked hard, long and faithfully, without success, to do that very thing. Would he appreciate what you passed along? It is needless to ask. It would do more. It would make him feel as if the A. E. S. was really founded upon educational principles and make him feel like passing his knowledge along.

You are indebted to the American Electro-platers' Society for interesting you in what could be gained by meeting with your fellow-craftsman. You are indebted to each member for the support they have given the Society to make it the success it is. Then in return "pass your knowledge along." You need not write a lengthy dissertation upon the chemical reaction of some complex salt in an electro-plating solution; most of us could not do so if we wished to; but what we can do is to tell our experience in plain language and

criticise the articles published. If the feeling of modesty stops you because of seeing your name in print or not wishing to be published as the author of a comment for fear you may be wrong, ask the Editor not to publish your name, but sign your articles as an evidence of good faith. You may say with the prophet of old "silver and gold have I none, but such as I have I give unto thee." You have some manner of producing a finish; some method of analysing a solution; some definite information as to the value of the many chemicals and plating salts used; some data, the result of an investigation which may help many. Pass along your knowledge. Write your opinions of the processes published in the *QUARTERLY REVIEW*. Criticise in a friendly way. Give what you can and receive in return much to broaden you and make you feel that you are of value to your fellow-plater, your fellow-member of the A. E. S.

G. B. H.

Chicago's Banquet, December 13, 1913

ON Saturday evening, December 13th, the members of the Chicago Branch of the American Electro-platers' Society gave their second annual banquet, in the "Empire Room" of the Grand Pacific Hotel. A large number of guests honored the Branch by their presence, and everyone was keenly interested in the splendid program that the Committee had arranged.

J. H. Hansjosten, President of Chicago Branch, acted as toastmaster, and in his address he spoke of the progress made during the past year, and urged the platers present who were not members to come within the fold.

The toastmaster then introduced Mr. Chas. H. Proctor, first president and founder of the Society, who made a splendid address and was heartily applauded. Mr. Proctor's address appears in the REVIEW.

Mr. F. J. Liscomb then followed with a paper on "What are Conducting Salts?" As will be seen in another column, Mr. Liscomb's paper is a deeply interesting one, and was listened to with great interest by all present.

"The Artificial Production of Colors on Metal" was the subject of Mr. H. E. Willmore's paper, and to say that it is on par with this gentleman's previous papers on this subject, is paying it a very high compliment. Mr. Willmore was at his best, and his paper was greatly appreciated.

Prof. Oliver P. Watts, Ph.D., of the University of Wisconsin, and an honorary member of Chicago Branch, was greeted with hearty applause when he arose to speak. His subject, "Theory and Practice of Black Nickel Deposition," was a splendid paper and of great interest to the members, many of whom are using black nickel solutions.

"The Modern Dynamo," per S. E. Huenerfauth's paper, was a comprehensive treatise on the modern dynamo, by a man who knows dynamos, and was greatly interesting.

Mr. F. B. Emery, Instructor of Chemistry of the Y. M. C. A., who is guiding the members of Chicago Branch through the mysteries of chemistry, spoke of the pleasure it gave him to teach men so willing to learn as his pupils of Chicago Branch were.

The toastmaster introduced Dr. William A. Jones as the man who presided at the first meeting of Chicago Branch, and stated at that meeting less than two years ago, there were two members present in person and one reported by 'phone. Dr. Jones spoke in his usually happy way and congratulated the members of Chicago Branch on the progress they had made.

Mr. H. A. Starrett was called on and added to the enjoyment of the occasion by telling in a humorous way some of his experiences and the experiences of some others.

The program being concluded, the meeting adjourned, voted by all a pleasant and enjoyable event.

President Hansjosten's Address

BANQUET OF CHICAGO BRANCH, DECEMBER 13TH, 1913

THE year that has passed is one that may be marked down as an era of progress in the history of American Electro-platers' Society. Our gain in membership is only one of the many things that may be considered a milestone on the road to progress, and yet that road is only half traveled, and many obstacles must yet be overcome before we attain the goal we have set for ourselves. In striving to reach this, we need the assistance, not only of every member in the Society today, but of every plater in America, and he needs the benefits derived from being a member of this Society as much as the Society needs him.

We know that much benefit has been derived by each of us from being a member of the American Electro-platers' Society, and it remains for the present members to nourish the seeds already planted and make the plater who is not yet one of us seek the benefits to be derived by being a member, and eventually make all platers eligible to membership, members of this Society.

There are many things that we have accomplished during the past year; among other things, we have taken up a course in chemistry that will help any plater who is now a member of this Society to analyze any solution that he may be entrusted with, and every branch of chemistry that pertains to the science of electroplating will be taught him; this feature alone, is one of the many that should cause every plater to seek membership with our Society.

As there are a number of speakers on the program tonight who are more able to discuss the many phases, I will not take up any more of your time, but will introduce our worthy Mr. Proctor.

Mr. Charles H. Proctor's Address

Mr. President, members and guests of the Chicago Branch American Electro-platers' Society:

It gives me great pleasure this evening to have the honor of being present at this your second annual banquet, not only as the founder of the American Electro-platers' Society and its first past president, but also as a representative of the Supreme President, Mr. George B. Hogaboom, who I am sure regrets very much that he is unable to be present with us this evening.

I am impressed with the remarkable advance you have made since the formation of the Chicago Branch in May, 1911, at which time I had the pleasure of meeting with you. Since that time I have watched your remarkable growth in membership and the interest

displayed by your members, which proves that the formation of the American Electro-platers' Society has accomplished wonderful results during its short history in bringing the members of the plating fraternity together upon the common level. It proves that in Union there is Strength, and in Knowledge there is Power. This latter phrase, the motto of the Society, I am sure implies very forcibly to the modern development in the art of electro-plating.

In the few years that have passed since the formation of the American Electro-platers' Society in February, 1909, no society of a like nature has ever shown such a natural and healthy development. At the present time we have thirteen branches, as follows: New York, Chicago, Philadelphia, Toronto (Canada), Detroit, Dayton, Cincinnati, Rochester, Indianapolis, Milwaukee, St. Louis, Newark, N. J., and Buffalo. These Branch Societies are governed by a Supreme Body, the second convention of which will be held in Chicago in June, 1914, and I am sure Chicago will be equal to the occasion and will extend that welcome to the representatives of the various branches gathered together at that time in a manner that will prove that Chicago knows how.

In my visits to this wonderful city at various periods, the right-hand of good fellowship has always been extended to me, and I have felt as much at home here in your city as if I were in New York.

I am not going to take up much of your time in addressing you as I note by your program a number of well-known gentlemen are to follow, and as I am a good listener, I am sure that the remarks to follow and the papers to be presented will prove of much value to me and to you as practical men.

One important feature in the future development of electro-plating that comes to my mind, will be a thorough understanding of the chemistry of electro-plating. We all know how much attention has been paid to the mechanical and electrical developments of the art, by which methods many articles have been plated upon a commercial scale, that in years gone by would have been prohibitive on account of the cost of manipulations of the product. One thing that impressed me very forcibly at your last regular meeting was, that your members are taking up a practical study of chemistry. The remarks made at that time, and the close attention followed by the members present, prove that this study is an important step in the right direction, from which much value will result to you as foreman platers and practical men. Chemistry and electro-chemistry is the very foundation of your art, a thorough study of which will be absolutely necessary in the future for the practical man, if he desires to keep step with the advance of time. With a knowledge of chemistry will come the light from the darkness, and many of the difficulties emanating from unknown causes in your daily vocations, that have caused you many sleepless nights and troubled days will be only as a dream, because you will know why these difficulties occur and with your superior knowledge will be able to solve them in their true relation to each other, and prove that the motto of the Society,

"Knowledge is Power," has a greater significance in your future development than has ever occurred to you.

We are living in an age that is practically a survival of the fittest, not only does this apply to the Electro-plater but to every vocation whatever be the rank or file, so that the man or woman who desires to reach the top of the ladder must continually apply his or her brain to acquire all the knowledge it is possible to obtain to retain a foremost place in the commercial ranks of today.

If the precepts of the American Electro-platers' Society are carried out in practice, I am sure that the art of electro-plating will reach a higher level, and a wonderful impetus will be given to your vocation, that will demand recognition on every hand.

As members of the American Electro-platers' Society you should feel proud to wear its badge of distinction, because from the early investigations of the transmutation of one metal to another in the latter part of the eighteenth and the early years of the nineteenth century, have come all the wonderful developments of electrical energy, that we behold on every hand. The wonderful production of chemicals from the air upon a commercial scale in Norway and Sweden is primarily due to this same wonderful energy. Your art in its early infancy was the sponsor for all the material wealth that have emanated from these investigations in those early years by your progenitors.

I trust that the interest you have shown from the time of your formation will continue, and that your membership will be greatly increased from the results of this, your second annual banquet.

I wish to congratulate you upon your selection of such an able leader as your President, Mr. Hansjosten, and I am sure that the work he has accomplished here for the good of the Society at large, will bear fruit in the near future, and the highest honors within the gift of the Society will be placed in his hands, not only as a reward for services faithfully performed, but as an honor to the American Electro-platers' Society and the Chicago Branch.

Following are the papers which were read at the Banquet:

What are Conducting Salts?

F. J. LISCOMB.

IN the manipulation of the various kinds of plating solutions we resort to the use of many chemicals to aid us in the production of certain results. Some of the salts are added as brighteners, others aid in dissolving the anode by removing the oxides formed during the decomposition of the solution due to the action of the current, etc.

Generally speaking, these chemicals are called conducting salts. Just why this is so, I am unable to explain, as many of the so-called conducting salts act more like non-conductors when added to the bath.

That is to say, when certain chemicals are added to the bath they do quicken the action, and permit the use of a larger amperage; there are others that if present in the same solution will counteract to some extent the good done by the other, and sometimes actually retard, rather than accelerate. Again, under other conditions this same salt that acted as a retarder will act as a conductor, and reduce the resistance of the bath.

Bi-sulphite and carbonate of soda have been considered as conducting salts. An eight ounce to the gallon solution of each was prepared and the resistance measured and found to be 80 ohms for the former and 70 ohms for the latter.

Two ounces of carbonate of zinc and two ounces of carbonate of copper were dissolved in sufficient cyanide and the solution made up to one gallon. The resistance was found to be 18 ohms on applying the current of three volts, and apparently only zinc was deposited. Four ounces each of bi-sulphate and carbonate of soda were then dissolved in the solution, with no addition of water, and the resistance again measured. It was found to be still 18 ohms. While the salts did not reduce the resistance, they did work a change of some sort, because the solution then gave an elegant deposit of brass. The change was due to some other property of the salts and is therefore beside the question.

To study the action of chemicals as an aid to the conductivity of the plating bath many new solutions were made, and old solutions gathered. Their resistance was measured and compared. Many of the figures are given below.

The carrying capacity of a square foot of ordinary nickel solution six inches deep, is from 10 to 20 amperes. In the practice of nickel plating 4 to 6 amperes are used per square foot. Just why then, we add conducting salts to this solution and then choke the circuit with a rheostat, I am unable to say. In making the following tests no attempt has been made to arrive at absolutely correct figures, and certain factors that would enter into a scientific test have been ignored, in the interest of simplicity. After you have compared the percentages, you will agree with me that awkward fractions

and other minutiae would not materially change the average. In making these tests a column of solution six inches long and one inch square is considered and used as a standard on which to base calculations. Suitable electrodes were fixed six inches apart and the resistance of the solution measured on a Wheatstone bridge and rheostat, using a telephone receiver instead of a galvanometer, this being an accepted method of measuring the resistance of an electrolyte. Prof. C. F. Burgess has described a simple and accurate method for doing this work, and I think the time will come when the plater will consider such a meter as a necessary part of the plating room equipment. The only reason it was not used in this article was because it was not at hand.

One of the earliest formulae for a nickel plating solution called for 12 ounces of double nickel salts dissolved in one gallon of water (see A). Such a solution was made and the resistance measured and found to be 47 ohms. This will be considered as a standard solution of 100 per cent. conductivity.

Twelve ounces of double salts is about all that can be dissolved in one gallon of water at ordinary temperature. Then if other salts are to be added as conducting salts, it will be necessary to add more water or less double salts, so that the conducting salts may be soluble in the solution.

Let us see how this works (see B). Add $\frac{3}{10}$ gallon of water to make room for the so-called conducting salts; this act increases the resistance to 54 ohms, an increase of 13%. As a comparison, take a nickel solution that appeared in a recent trade journal; use this because there are many ingredients (see E), as follows:

12 oz. Double salts.
2 oz. Sal ammoniac.
2 oz. Single salts.
2 oz. Boric Acid.
1 gal. water.

One gallon will not hold all these salts so the solution is increased to $1\frac{3}{10}$ gallons.

The solution was made by first dissolving the double salts in water, and the resistance measured. The other chemicals were added one at a time and the resistance noted for each addition.

A glance will show that all salts may not be considered as conducting salts although they may be of benefit to a solution by merely being present, a subject which will not be considered here.

Returning to the solution with 54 ohms resistance, (B), add two ounces of sal ammoniac to the gallon. In this we find a conducting salt that reduces the resistance to 32 ohms or about 40% (C). We get back the 13% lost by diluting the solution and are 27% to the good.

On the further addition of chemicals other results are obtained. With the addition of two ounces of single nickel salts to the solution (D), the resistance is increased to 39 ohms, or increasing instead of reducing the resistance. Two ounces of boric acid are

then added (E), and the resistance of the solution is now 40 ohms, only 14% better than the ordinary simple nickel solution.

Judging by the figures given in the extreme right column of table No. 1 it is useless to add a chemical of higher resistance to a solution of lower resistance to increase the conductivity of the latter.

Sp. Gv. Be.	Table 1 Remarks	Magnesium Sulph.	Water, Gals.	D. Ni. Salts, oz.	S. Ni. Salts, oz.	Sal Ammoniac, oz.	Boric Acid, oz.	Temp. Fahr.	Ohms Resist-		Resistance	Per Cent. Conductivity
									Increase	Decrease		
7½	A	.....	1	12	.....	.....	.....	Room Temp. 70°	.....	.....	47	100%
7¼	B	Diluted	13/10	12	.....	.....	.....		7	.....	54	—85
.....	C	.....	13/10	12	.....	2	.....		.....	15	32	1.32
.....	D	.....	13/10	12	2	2	.....		8	.....	39	1.17
8½	E	.....	13/10	12	2	2	.....		7	.....	40	1.14
7½	EA	4	1	8	.....	.....	.....		11	.....	58	—77

From these figures you will also gather that except for a benefit of a catalytic nature that the solution receives, all might be left out except the sal ammoniac.

It is not the intention of this paper to discourage the use of conducting salts and certain other chemicals for improving the condition of a plating solution, as there are times when the addition of single salts will help, as will be shown later on.

Another solution tested was composed of:

(EA) 8 oz. Double Salts
4 oz. Sulphate of Magnesia
1 gal. water.

The specific gravity of (EA) being 7½ degrees Be. about equals that of (A), yet this has a resistance of 58 ohms—about 22% more than (A).

Another solution tried was composed of:

Single Salts 24 oz. 14½ Be.
Boric Acid 1½ oz.
Chloride Soda ½ oz. 69 ohms
Water gals.

The above are all new solutions and have never been used for plating purposes.

Several brands of high power nickel salts have been measured for conductivity. The Capstone brand heads the list, it being a 25% better conductor than solution (A), Table No. 1. Others range downward to 8%.

A word about old used nickel solutions may be of interest.

In all twelve perfectly good solutions which were measured, the specific gravity ranged from 8 degrees to 10 degrees Be. The resistance ranged from 45 to 63 ohms. Only one of the twelve had a lower number than the solution shown—see (A). Table No. 2 shows the figures on two of the twelve.

TABLE 2		Sp. Gv.	Resist.	Age	Contents
Old Nickel Sol.....	F	9	62	2.y	Unknown
“ “ “	G	8	63	14.y	D. Salts

No attempt will be made at this time to draw any conclusions as to how they might be improved, for the very good and sufficient reason that they are all working very satisfactorily. An exception will be made in those listed in Table No. 2, just to illustrate a point. It will be noted that the resistance of (G) is about .333% higher than (A). The solution is fourteen years old, and nothing but double salts have been added in all that time. The bath may need metal—that being the case, would a conducting salt help the bath?

Enough single salts was added to the bath to bring the specific gravity up to 10 degrees Be. The resistance fell from 63 to 57 ohms; compare (G) with (C) and (D) and you will find that in (G) the single salts acts as a conducting salt, while in (D) as compared with (C) it does not.

The figures shown in the ohms resistance column represent the resistance of a column six inches long and an aliquot part of a square foot. This will give a square foot of solution 6" deep and a carrying capacity of about 15 amperes at 5 volts, for (A). More than 5 or 6 amperes per square foot are seldom used. Then why conducting salts? Even that 14-years-old has a carrying capacity of over eleven amperes.

The electrical resistance of solutions of the chemicals used in the plating room is interesting. A few results are given below:

1. Cyanide (mixture).....	8 oz. to gal.	20 ohms resistance
2. Carbonate Potash	8 " " "	38 " "
3. Carbonate Soda	8 " " "	70 " "
4. Pyrophos	8 " " "	170 " "
5. Sulpho Cyanide Pot.	8 " " "	80 " "
6. Bi Sulp. Soda	8 " " "	80 " "
7. Chloride Soda	16 " " "	15 " "
8. Sal Ammonia	16 " " "	10 " "
Sol. of cyanide and Carb. Cop.....	15 " " "	15 " "
Sol. of cyanide and Carb. Cop.....	7½" " "	25 523-10-52-3/10

The total resistance of the above lot of solutions is about 523 ohms, the average 52 3/10 ohms. An equal part of each solution was taken and all mixed. It was found that the mixture had a resistance of 27 ohms instead of 52 3/10 ohms.

A cyanide and carbonate copper solution of 10-Be. has a resistance of 20 ohms.

Four ounces of carbonate of soda were added per gallon. Finally 4 ounces of bi Sulph of soda were added per gallon.

The specific gravity was then about 14-Be. but the resistance still remained at 20 ohms.

From this it looks as though we might reduce the resistance of a carbonate of soda solution with cyanide but not the reverse.

Three used silver solutions were tested:

1 made with Silver Chloride, free cyanide.....	12 7/10 oz.	15 ohms
1 made with Silver Cyanide, free cyanide.....	3 1/4 oz.	34 ohms
1 made with Silver Chloride, free cyanide.....	1 6/10 oz.	56 ohms

The first uses only 3/10 volt, as indicated on an ordinary voltmeter, with the second approximately 1/2 volt is used.

Several old brass, bronze and acid copper solutions were tested. (See Table).

TABLE 3				Re-	Free		Free	Sp.	Ohms
				marks	Acid	Metal	Cyanide, oz.	Gv. Be'.	Resistance
R	New	Acid	Copper Sol.	.....	1 1/2%	Q. S.	.....	15	18
S	Old	"	" "	.....	?	" "	.....	21	45
T	"	Cyanide	" "	.....	.....	" "	1 1/10	19	20
U	New	"	Brass "	Renew	.....	" "	1 3/4	9	28
V	Old	"	Copper "	N. G.	.....	Little	None	23	23
W	"	"	Brass "	.....	.....	Q. S.	8 3/10	32	17
X	"	"	Bronze "	.....	.....	" "	3 3/10	22	17
Y	"	"	Brass "	.....	.....	" "	9 1/10	28	19
Z	"	"	" "	.....	.....	Little	1 4/10	13	30

Note the resistance and the specific gravity, and quantity of free cyanide in the old brass (W) and old bronze (X), and tell why these solutions do not deposit the metal satisfactorily—certainly not because they are good conductors.

"T" in this table is the best solution of the series for yielding a copper deposit. The content of free cyanide is 1 1/10 and is hardly enough to keep the anodes clean throughout the day. It is not the best conductor, however. It looks, from my point of view, as though the plater should refrain from adding salts, alias conducting salts, to his solution, except it be to produce a result other than reducing resistance, and then only in the least possible quantities.

You are probably ready to ask me, where have we arrived? I can only say that we have not arrived, we are only on our way.

The question—What are conducting salts? has not been answered. We need an answer. We need it now!

F. J. LISCOMB,

The Hanson & Van Winkle Company.
Assoc. Member Chicago Branch A. E. S.

The Artificial Production of Colors on Metal

BY H. E. WILLMORE.

AMONG the various duties the electro-plater is called upon to perform none is more interesting than that of the coloring of metals, be they solid or deposited; and I will endeavor to present the details of a few of the methods in use for producing the artificial coloring of some of them. I shall confine myself in this article to the coloring only of copper and brass and to the use of chemicals that can be easily and cheaply procured. No especial claim is made to originality of the subject matter. Let it be further stated that its contents are from my own personal experience, and the formulas given are such as I have used repeatedly with satisfactory results for producing metal finishes. While any of the dips can be used on solid metal, they are not applicable to brass or copper plated iron or steel unless the deposit is very heavy.

The coloring of metals has been called by various names, among them, "oxidizing," "bronzing," "staining," etc.; but is more commonly known as "oxidizing." As oxygen has very little effect on some of the metals, this is incorrect; but since this is the term universally used to designate the coloring of metals, I have thought it advisable to use it in that sense throughout this paper. Whatever the term or methods used, the object is to impart by chemical agents an artistic or antique appearance to the surface of metals, which produces an effect of contrast, enhances its beauty, and makes it pleasing to the eye.

Many metals when passed through certain chemical solutions assume a variety of colors due to the formation of films of oxides or sulphides upon their surfaces, the quality of the color depending to a great extent upon its depth and the method of its formation. In all metal coloring processes, temperature, time of immersion, and concentration of the solution used exert considerable influence on the results obtained, and frequently it will be found necessary to repeat operations to produce desired results. There are many other little items that make for success which require a care and attention in operating that experience alone can impart. No formula for metal coloring, however simple, is of any value without intelligent manipulation.

While the coloring of metals presents no serious difficulties, many failures can be attributed to the improper preparation of work before its immersion in the coloring bath. Perfect cleanliness is therefore an important factor in obtaining the best possible final results.

Some of the metals are more susceptible to the coloring process than are others. Copper, for instance, forms the basis for a larger variety of colors than any other metal. These are known chiefly as "oxidized," "antique," and "old copper," most of which are obtained from the potassium sulphide solution of greater or less con-

centration. This solution is capable of producing a number of shades, from very light tints to jet black on copper, all finishes with which most platers are familiar. In producing the "statuary bronze" finish, which, according to taste may be light or dark, I prefer that the solution contains not more than 2 oz. of the liver of sulphur to the gallon of water, used cold, and scratch-brushed with a wet wheel, as this gives a more even finish than when a dry brush is used. "Mahogany bronze" is produced in the same manner; but should have only a momentary immersion in the dip. The lighter shades, when relieved with wet powdered pumice, give soft and pleasing contrasts. For producing darker tones the dip can contain 3 oz. of the sulphide to a gallon of water, with the addition of a little aqua ammonia. If, however, the solution is too strong, the work will present a smoky appearance and the film adheres badly, sometimes flaking off from the article treated. These dark shades, after drying, are scratch-brushed with a steel wheel and relieved or "spotted" on a rag buff, except in the case of sand blasted goods. This operation is best performed with wet pumice powder applied to the scratch-brush. On some kinds of work I have used the pumice moistened with kerosene oil, afterwards washing in benzine and drying in sawdust. This method will be found desirable when it is not advisable to put the article in water, on account of the porosity of the metal, after it has been thoroughly dried out before the relieving operation.

Heavily coppered articles can be given a brown finish known as "French Bronze" by immersion in a solution, maintained at the boiling point, containing 3 lbs. copper sulphate in 1 gallon of water and adding 1 oz. of caustic soda first dissolved in a small quantity of water. This dip requires careful watching. The work should be kept in motion during immersion and withdrawn occasionally for inspection as the coloring proceeds. When taken from the solution it must be well rinsed in water, dried, and scratch-brushed with a well-worn brass wheel, which gives it a very high lustre.

Other brown colors are obtained on copper by using barium sulphide $\frac{1}{2}$ oz., water, 1 gallon, used warm; or ammonium chloride, 3 oz.; potassium sulphide, 1 oz.; cold water, 1 gallon.

A purple shade is given to copper by dissolving in 1 gallon of hot water sodium hyposulphite, 8 oz., with the addition of $\frac{1}{2}$ oz. nitric acid. Scratch brush with a wet wheel before and after immersion, dry in hot water and sawdust.

The color of copper is deepened to a bright red with copper sulphate 2 lbs., common salt 2 lbs., hot water 1 gallon, going through the same operations as for the previous finish.

"Royal copper" is produced on solid copper or heavily plated goods by first coating with lead by the electrolytic method and then bringing to a red heat by means of the blowpipe or torch. It is not possible to apply this finish to plated white metal or soldered articles. This finish is brought to a high lustre by means of a cotton buff. Another method of producing this finish is to dip the copper or

copper plated articles in Nitrate of Potash contained in an iron kettle and brought to a high temperature. The reddish bronze color seen on medals is produced by this method after they have been sand blasted and coppered in an acid copper solution.

As brass is not always of the same composition it will be found that shades will differ as the alloy contains more or less zinc or other foreign metals. Sheet metal will also obtain different shades from that of the cast article when passed through the same dip. It is for this reason that difficulty is experienced in producing duplicate shades on a variety of brass articles, even when their composition differs but slightly. Taking for a standard solution $1\frac{1}{2}$ oz. of the yellow sulphide of antimony, 6 oz. caustic soda, and 1 gallon of water, any shade of brown can be produced on brass, from the light yellowish to a dark seal or chocolate color, by varying the concentration of the solution, changing its temperature, or regulating the duration of time work is in contact with it. These things have an important influence on results which can only be determined by practice. After coming from the dip, the work should be thoroughly dried and scratched-brushed. It will present an altogether different appearance after this operation has been performed. If it is too light in color, it can be returned to the dip until the desired shade is produced. It also makes a difference in the color as to whether the work enters the dip in a highly polished condition, scoured with wet pumice, or sand blasted.

Another solution for producing brown shades on brass consists of potassium chlorate $2\frac{1}{2}$ oz., copper sulphate $2\frac{1}{2}$ oz., water 1 gallon and used at a temperature of about 175° Fahr. As the article comes from this solution, it has a greenish brown sheen; but when dry scratch-brushed, is of an even cinnamon-brown color.

Brass can also be colored brown by adding potassium sulphide to a solution of sodium hydrate in the following proportions: Potassium sulphide 2 oz., caustic soda 8 oz., water 1 gallon. The shades of color depend on the temperature at which the solution is maintained.

A solution containing potassium sulphide alone gives no useful results on brass. There are several other dips that could be mentioned; but I think these will be found sufficient to produce any shade of brown desirable.

Brass will assume a red color by treatment with copper nitrate 8 oz., oxalic acid 8 oz., hot water 1 gallon. It can be given a blue color with a boiling solution of Lead acetate 3 oz., hyposulphite of soda 4 oz., in 1 gallon of water. Iridescent colors of red, brown, and green are obtained by substituting sulphuric acid for the lead salt.

The means of coloring brass black are many and varied, probably the most useful being the black nickel solution, as it does not require the attention some of the dips claim, although the dips are more desirable when small articles are to be blackened in bulk by means of baskets. For a jet black color, ammonia and copper carbon-

ate is more generally used. This consists of ammonia with copper carbonate added until the solution is thoroughly saturated and a little remains at the bottom of the container in the form of a black oxide. Water may be added in a small amount to reduce the strong fumes of ammonia. This dip will work satisfactorily only when kept at a high temperature. Arsenic enters largely into the composition of dips for coloring brass black; used either electrically or by simple immersion. Useful dips for the purpose are: Arsenic trioxide 2 lbs., sulphate of copper 8 oz., muriatic acid 1 gallon, used cold; or dissolve iron filings in muriatic acid to saturation, adding 1 lb. of arsenic for each gallon of solution. Another is to dissolve 2 oz. arsenious acid in 1 gallon of water containing 5 oz. of potassium cyanide. Any of these can be used as dips or the black deposited by means of the electric current.

Never in the history of metal coloring have there been as many finishes as can be found on the market to-day. It is to be desired that sometime in the near future there will be a National Standard designation for metal finishes to prevent the confusion that is now created by each manufacturer's having an individual name for the finishes on his product. In accepting a new position where metal color is performed, the plater will be requested to finish some of the work in "antique copper" or "old brass." The name means nothing to him; for in a previous position they may have been called "oxidized copper" or "old copper," or "oxidized," "antique," or "Flemish" brass. Any of these may represent a number of finishes with their great variety of relievings and shadings. A customer under present conditions is also at a loss to know by what name he shall ask for the finish he requires when making his purchase.

Black Nickel Solutions

OLIVER P. WATTS.

It is not an easy matter for a man whose only connection with electro-plating has consisted in attempting to teach the elementary principles of the art to a class of college boys for two months each year, to say anything of value to a body of men who have practiced electro-plating twelve months a year for many years. I fully realize this. Yet when your secretary asked me to put myself in this difficult situation I thought only of the cordial reception you gave me a year ago, and so, unwisely perhaps, I consented to address you this evening. Should my remarks consist only of what is perfectly well-known to you, consider my limitations and at least credit me with good intentions.

A problem which is attracting the attention of electro-platers very widely at present, is the deposition of black nickel, and I would like to confine my remarks this evening to that subject. For the past month or more, I have been carrying on a series of experiments, hoping to obtain some results which might prove of value to the practical electro-plater. While many of the results have a purely negative value, I trust that I may be able to make a few suggestions that will prove welcome.

In considering this subject at length, I have had recourse to the various books on electro-plating and files of technical periodicals which the University Library has afforded, but these have not been sufficient for entirely satisfactory results. The history of the so-called black nickel solution appears to be recent, the first mention of it I have found dating back to 1889. To follow its history, and to give in detail the various baths which have been proposed for use would require more time than is at our disposal this evening, but if any one wishes this information, the paper in full will be published at some later date, and will thus be available in complete form. For our purposes, however, it will be sufficient to divide the various solutions recommended for the deposition of black nickel into three classes: First, solutions containing no nickel in their original composition or subsequent use, an arsenic compound being usually the essential constituent of the solution; second, arsenic solutions which contain nickel, either put in as a nickel salt when the bath is made up, or introduced during use by employing nickel anodes; third, nickel solutions which contain neither arsenic or antimony. The last named metal yields deposits which closely resemble those of arsenic.

To call deposits from solutions of the first class "black nickel" is a self-evident case of misbranding, which should not be tolerated by either the plating industry or the public. Solutions of the second class, whether they contain much or little nickel, will, in the speaker's opinion, yield a deposit consisting mainly, or even entirely of metallic arsenic, whenever this element is present in the solution in any considerable amount. Both of these form a plating which is a distinct menace to health, and the use of arsenic in plating solutions should be entirely discontinued.

In attempting to trace the history of the black nickel solution from the first solution thus named to the present, I have found the following probable development. By the addition of nickel salts to some of the arsenic solutions used as dips or with the current for producing dark colors upon certain metals, the deposit was called black nickel. Then other substances were added, and finally the arsenic was omitted, producing the true black nickel solution.

The earliest black nickel solution seems to be that described by C. H. Proctor*: "About eighteen years ago there was an unusual demand for antique finishes such as we find upon the market today. * * * This brought forth much experimenting among platers to produce a black deposit to be used for relief purposes in the produc-

*The Metal Industry, 1907, p. 18.

tion of this finish. The result was the black nickel solution which is used by many platers at the present time, and which gives excellent results. This formula consisted of 8 oz. double nickel salts and 4 oz. common salt to each gallon of water. This is to be worked for a short time with the electric current until it is in good condition. One to two ounces of ammonia per gallon is then added, and potassium cyanide until the precipitate is redissolved. One pound of arsenic and two and one-half pounds of cyanide is dissolved in one-half gallon of hot water. Enough of this solution was added to the nickel bath to produce a beautiful black deposit upon polished brass, bronze, copper, or silver. * * * Nickel anodes were used." This makes the date of the first black nickel solutions about 1889. No mention of black nickel solutions occurs in books on plating by Maigne and Mathey, published in France in 1891, by Langbein, Philadelphia 1893, Brunor, Philadelphia in 1894, and Watt and Philip, published in England in 1902. The several solutions which follow have been taken from such periodicals as were accessible. The composition is given both in ounces per gallon, and grams per liter.

2. Brass World, 1905, p. 11.

10 oz. double sulphate of nickel.....	75 grams
2½ oz. potassium sulphocyanide.....	19 grams
1½ oz. copper carbonate	12 grams
1½ oz. white arsenic	12 grams

"Nickel anodes are used. The amount of arsenic in the bath determines the blackness of the deposit. The arsenic is not consumed." This is a bath of class 2, as solutions were previously classified. I doubt the correctness of the last statement.

3. Brass World, 1906, p. 263.

8 oz. double sulphate of nickel.....	60 grams
2 oz. potassium sulphocyanide	15 grams
1 oz. zinc sulphate, cryst.	7.5 grams

This is the first solution of class 3 that I found. The function of the zinc sulphate will be referred to later. Nickel anodes:

4. Metal Industry, 1907, p. 18, C. H. Proctor.

5 oz. nickel sulphate (single)	37.5 grams
3 oz. ammonium chloride	22.5 grams
2½ oz. potassium sulphocyanide	18.7 grams
2 oz. ammonia	15 c. c.
½ oz. sodium bisulphite	3.7 grams

"Brass anodes should be used. Some platers have proposed adding sulphate of zinc, but to do impairs the luster of the deposit and gives it a muddy appearance. * * * In all cases the solution should be electrolyzed for some time before using." Electrolysis with brass anodes is only another method of adding the sulphates of zinc and copper.

5. Metal Industry, 1907, p. 214.

1 oz. copper carbonate	7.5 grams
½ oz. zinc carbonate	3.7 grams
1 oz. ammonium chloride	7.5 grams

1 oz. white arsenic	7.5 grams
2 oz. caustic soda	15 grams
1 oz. nickel sulphate	7.5 grams
6 oz. potassium cyanide	45 grams

Sheet brass anodes were used. It is a safe prediction that the deposit from this solution will consist mainly of metallic arsenic.

6. Brass World, 1908, p. 9. A soft black nickel.

4 lbs. sal soda.	
1 pint ammonia saturated with nickel carbonate	
2 oz. ammonia saturated with zinc carbonate.	
1 oz. ammonia saturated with copper carbonate.	

Anodes of nickel, iron, or carbon. 1 to 3 volts is preferable, although 4 to 5 volts may be used. The same "black nickel solution" is given, with the nickel left out, and iron anodes, in Brass World, 1910, p. 220.

7. Metal Industry, 1909, p. 12.

12 oz. double sulphate of nickel.....	90 grams
2 oz. white arsenic	15 grams
2 oz. ammonium carbonate	15 grams
1 lb. conc. ammonia	120 grams

potassium cyanide to clear.

Nickel anodes are used, and the solution is said to give a deposit that is black, not gray, and which will not fade or tarnish. Lacquering is hardly necessary. The solution stands at 8-9° Be, and is run at 2 to 4 volts.

8. Metal Industry, 1911, p. 313.

1 gal. hot conc. muriatic acid	1000 c. c.
2 lbs. white arsenic	240 grams
4 oz. nickel sulphate	30 grams
1/8 oz. copper sulphate	4 grams

Use nickel anodes and a weak current.

9. Metal Industry, 1912, p. 88.

6 oz. double sulphate of nickel.	
4 oz. ammonium chloride.	
1 oz. nickel sulphate.	
2 oz. potassium sulphocyanide.	

1 teaspoonful of a solution consisting of 1 part copper carbonate in 2 parts ammonia. Brass anodes.

10. Brass World, 1912, p. 56.

10 oz. double sulphate of nickel.....	75 grams
2 oz. ammonium sulphocyanide	15 grams
2 oz. zinc sulphate	15 grams

E. M. F. less than one volt, temperature 70 to 100° F., anodes of nickel, time for a good deposit 1/2 hour or 1 hour. "It has been found expedient to increase the amounts of double nickel salts and zinc sulphate as the deposit seems to be more uniform." Acidity should be neutralized by nickel carbonate.

11. Brass World, 1912, p. 353.

- A. 1 pint ammonia.
10 parts nickel carbonate.
1 part copper carbonate.

B. 1 gallon water, saturated by sal soda.

Add A to B, use cold with iron or steel anodes and the same current as for white nickel. The solution gives a very black and permanent deposit. This solution is unusual in that it contains neither arsenic nor a sulphocyanide.

A few of many comments upon black nickel solutions and their use follow:

"A black nickel solution works more uniformly if heated to 100° F."²

"In the electro-deposition of black nickel the best results are always obtained by depositing it over a freshly plated white nickel surface."³

"The electro-plating of black nickel and other black deposits, such as the well-known arsenic deposits, in baskets is often a source of much trouble. After the basket has become coated over with the black deposit the electro-deposition is much slower, and the articles fail to receive a good deposit. After a time it is almost impossible to deposit at all. The method of overcoming trouble is to strike up the basket in a copper or brass solution after each batch of work has been plated, so as to render it a better conductor."³

"The old black nickel formulas all contained arsenic as one of the ingredients, and this fact has precluded their use in many ways. The color obtained was not as satisfactory as desired in many cases, and the fact that arsenic deposits with the nickel renders the deposit somewhat fugitive. Such black nickel formulas are not extensively used at the present time, and they can scarcely be considered reliable. Better results are produced when black nickel is deposited upon freshly deposited white nickel. The black nickel deposit consists of nickel sulphide. With it a small quantity of zinc sulphide is deposited. This zinc sulphide often gives a gray or brown shade to the deposit. Dipping for 5 to 15 seconds in a solution of 12 oz. ferric chloride and 1 oz. muriatic acid per gallon of water transforms the deposit from one with a gray lustre to a deep and dead black color. All black nickel deposits should be lacquered."⁴

"Black nickel is beginning to be used quite extensively. No other plating solution in use at the present time is the cause of so much trouble."⁵

"Either ammonium or potassium sulphocyanide may be used. Ten to twenty minutes is required for a good deposit. Too thick deposits may flake off. Black nickel may be plated on any metal

² Brass World, 1908, p. 162.

³ Brass World, 1908, p. 223.

⁴ Brass World, 1908, p. 227.

⁵ Brass World, 1910, p. 253.

which will receive white nickel. The claim that the deposit takes better on white nickel is doubtful. The full black is obtained only on polished metal. The solution must be kept strictly neutral as acid makes the deposit gray or streaky, and alkali causes brittleness and flaking off."⁶

"Question. Can black nickel be deposited in barrel plating?

Ans. Black nickel does not seem to lend itself well to plating in the barrel. The reason appears to be that the black deposit is a very poor conductor of electricity and when the deposit forms it then causes a poor contact so that the current passes with much difficulty. As far as we know black nickel is not being plated on small metal goods in a plating barrel."⁷

A. Brochet,⁸ speaking of black nickel, says: "It seems to consist of a deposit of nickel and carbon, and could probably be replaced by a deposit of another metal brought about under similar conditions. A deposit of black nickel is easily obtained by diluting an old bath to a fourth its strength and adding for each liter 50 grams of ammonia and 50 grams of a hyposulphite. The latter can be replaced by a neutral sulphite, or bisulphite, or a little potassium cyanide."

It was found impossible to include all published black nickel solutions without unduly extending this paper, but it is hoped that the solutions selected are fairly representative of practice. Their chronological arrangement should indicate what progress, if any, has been made, and whether or not any solution has been adopted as standard.

Arsenic is present in solutions 1, 2, 5, 7, 8.

A sulphocyanide is present in solutions 2, 3, 4, 9, 10.

Copper is a constituent of 2, 5, 6, 8, 9.

Zinc is a constituent of 3, 5, 6, 10, 11.

The use of brass anodes puts copper and zinc into 4, 5, 9.

Nickel anodes are specified for 2, 3, 7, 8.

The presence of copper or zinc in many of the above solutions is for the production of a darker deposit than is obtained in their absence. If the solutions given above are representative of actual practice it is evident that there is as yet no real standard black nickel. A finish so-called may be arsenic, or a mixture of arsenic with nickel, copper or zinc, or with one or more of their sulphides; it may consist of nickel sulphide, or a mixture of the sulphides of nickel, copper and zinc; or it may consist of still other substances.

For the past month the speaker has been working over time to render this confused state of affairs even worse confounded, by trying to discover a lot of new solutions which would yield black finishes containing other metals than nickel. These experiments will be briefly described.

⁶ Brass World, 1912, p. 281.

⁷ Brass World, 1913, p. 68.

⁸ Manuel pratique de galvanoplastie, p. 257. Pub. Paris, 1908.

On the assumption that the true black nickel deposit consists of nickel sulphide, it appeared possible than any metal whose sulphide is black might yield a satisfactory deposit. The sulphides of the following metals are black or very dark in color: bismuth, cobalt, copper, iron, lead, mercury, nickel, silver and tin. Having once tried to do silver plating from an old photographic fixing bath and obtaining a black deposit of silver sulphide instead of the white silver desired, I now decided to try sodium hyposulphite as a substance likely to yield sulphur under the influence of the electric current.

Salts of various metals were dissolved in a solution of "hypo" containing 60 grams per liter. Current densities are expressed in amperes per square foot.

Exp. 1. 25 grams of tin chloride per liter. At 3 amperes per square foot, this gave a dark smut on copper, which easily rubbed off.

Exp. 2. The double sulphate of nickel used similarly, gave a deposit of white nickel.

Exp. 3. On adding 25 grams lead acetate to the previous solution a good dark gray deposit was obtained, which took a fine polish. Temperature 140° F. (60° c). Current density 1 ampere.

Exp. 4. Lead acetate, 25 grams per liter, gave a dark, poor deposit, mainly metallic lead.

Exp. 5. Copper sulphate, 35 grams, gave only a yellowish tarnish, at current densities of 1½, 3 and 4½ amperes. Made alkaline by ammonia it gives a black smut at high current density.

Exp. 6. An old photographic fixing bath gave a dark brown, but non-adherent deposit. A lacquered sample is shown.

This series of experiments with hyposulphites of the metals proved a disappointment, the only one that gave promising results being the combination of nickel and lead salts.

A new series of experiments was then tried with sulphocyanides of a number of metals. According to Comey's Dictionary of Solubilities, the sulphocyanides of bismuth, copper, lead, mercury and silver are insoluble in water, while those of cobalt, iron and nickel are readily soluble, and that of zinc slightly soluble in water.

Exp. 7. Although bismuth sulphocyanide is insoluble in water, it is soluble in nitric acid, and a solution was prepared by adding ammonium sulphocyanide to an acidified solution of bismuth nitrate. This solution produced a heavy black deposit on copper without the use of the current, but it was all rubbed off by the finger. On platinum the current gave a dark brown deposit which rubbed off rather easily. After adding citric acid to the solution it is possible to neutralize it by ammonia without causing precipitation of the bismuth. This solution does not blacken copper on immersion and the current produces a deposit that adheres slightly better than the first.

Exp. 8. Ammonium sulphocyanide was added to a solution of cobalt nitrate, and in ½ hour a good deposit was obtained, about

as dark as the black nickel deposit when the special blacking agents are not added. A sample is shown.

Exp. 9. Although copper sulphocyanide is insoluble in water it is soluble in ammonia or in a solution of ammonium sulphocyanide. 25 grams of ammonium sulphocyanide and 60 grams of copper sulphate per liter, containing much undissolved copper sulphocyanide, gave no deposit. More ammonium sulphocyanide was added with a like result. Finally enough ammonia was added to clear the solution, and still no deposit was obtained by the current.

Exp. 10. A solution of 50 grams ferrous ammonium sulphate and 25 grams ammonium sulphocyanide per liter, at $1\frac{1}{2}$ amperes per square foot gave a dark gray deposit. The addition of 10 grams zinc sulphate caused the deposit to become a fine black, which takes a good polish. This is equal to black nickel in appearance, but the solution is an unsatisfactory one to work on account of the formation of iron rust, and the frequent failure of the deposit to cover completely. Iron anodes were used. A sample is shown.

A similar solution of ferric chloride was tried, but this corroded both copper and nickel so rapidly that it is unsatisfactory. The color of the deposit was excellent.

Exp. 11. This was a comparison of the relative effect of the sulphates of zinc and of copper in darkening the black nickel deposit obtained from a solution of the double sulphate of nickel, containing ammonium sulphocyanide.

A deposit was made from solution No. 3 at a current density of 1 ampere per square foot, and a beautiful dark color was obtained. This stood polishing perfectly. A similar solution was then made up but with copper sulphate in place of the zinc sulphate. The deposit from this solution was a trifle blacker than the other but was so soft that it was instantly removed by the polishing wheel. Sample of both are shown.

Having been unsuccessful in attempts to prepare a black nickel solution from published formulas, in 1908 the speaker purchased a solution already prepared from one of the plater's supply houses. Its composition was:

8 oz. double sulphate of nickel	60 grams
1 pint ammonia	125 c. c.
3 oz. potassium sulphocyanide	22 grams
2 oz. white arsenic	15 grams
3 oz. ammonium carbonate	22 grams
6 to 9 oz. potassium cyanide.....	45 to 67 grams
1 gal. water	1000 c. c.

Several deposits at $\frac{1}{2}$ ampere per square foot were made on platinum. An analysis of one of these by Mr. W. G. Crawford, of the Department of Chemistry, showed that it contained 91 per cent. arsenic, and 8.3 per cent. nickel. It contained no sulphur.

It seemed of interest to determine the current efficiency of some of the black nickel solutions.

From the solution last mentioned 0.902 grams per ampere hour was deposited, a current efficiency of 95.7 per cent., calculated for

the composition found by analysis. Faraday's law requires 0.9324 grams of arsenic, and 1.095 grams of nickel per ampere hour.

Qualitative tests on the deposit from solution No. 3 showed that it contained both nickel and sulphur. The published statements that the deposit from this solution is nickel sulphide, is probably correct. This solution gave 1.57 grams per ampere hour, which leads to a current efficiency of 93.2 per cent.

Exp. 12. Black Nickel on Aluminum.

Having experienced the usual difficulties when trying to plate aluminum with other metals, the speaker was not surprised to find the following statement twice repeated in one of the plating trade journals,⁹ in answer to questions from correspondents: "There is no method of blackening aluminum by the use of a solution or by plating that is satisfactory." You can imagine my delight at obtaining firmly adherent deposits of black nickel upon aluminum from solution No. 3. The deposition is carried out just as for any other metal, and the coating seems to adhere quite as well as upon copper or nickel. The samples exhibited were prepared too recently to be certain that time will not cause the deposit to peel off, as has happened in the case of many previous deposits upon aluminum, but so far there is no sign of peeling. The color is as yet unsatisfactory, being of a brownish tone. This is probably due to its being deposited over a matte instead of a polished surface, as all attempts to clean the aluminum without destroying the polish, have failed. Experiments are, however, being continued, and suggestions along this line will be welcome.

The trouble frequently reported in basket plating of small objects with black nickel can be overcome more simply than by the suggested remedy of coppering the basket after each batch of work, provided the use of aluminum baskets is permissible. Aluminum is used for dipping baskets. Could it not also be employed for plating baskets? In this case it is only necessary to dip the basket a few seconds in a mixture of equal volumes of nitric and sulphuric acids, diluted with water to any degree which suits the operator. The nickel sulphide is quickly removed and the aluminum is not attacked by the acid.

In closing, I wish to thank you for the privilege of being present to-night, and to express as a New Year's wish that the next annual banquet may see an advancement in the American Electro-Platers' Society, at least equal to the splendid record of the past year. May the Quarterly, in particular, increase in size and value. It is the Quarterly which brings to each member a realization that he belongs to a great international society, and not merely the Chicago branch. The twenty-three bound volumes of the transactions of the American Electrochemical Society, constitute the most valued part of my professional library. Six years hence may every member of this younger A. E. S. be able to say the same of the Quarterly.

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⁹ Brass World, 1911, p. 335; 1912, p. 411.

The Modern Dynamo

By S. E. HUENERFAUTH,

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THIS is a subject in which every Plater is interested for the reason that without the Dynamo or a current supply from some other source, it would be impossible for him to do any plating.

You are all familiar with Dynamos in connection with the art of electroplating. Some of you have had years of experience, which dates back to the time when the only machines available were what are known as "Bi-polar" type of dynamo. These were built in small units with very few parts in the armature, and were generally shunt wound.

To-day we have nearly reached the climax of perfection in Dynamos for electro-plating, for to-day we have the Multipolar Compound Wound Dynamo with the Composition Brush, and which will be explained as we proceed with this article.

The developments in Dynamo construction for electro-plating have been very rapid in the last two and a half years. The first important step in developing the Modern Dynamo was the application of the self-lubricating and self-adjusting brush. This has enabled us to overcome nearly all of the troublesome as well as objectionable features contained in the old type of dynamos, which was the brush trouble. To overcome this with the new brush was no small undertaking for the reason that the carbon or graphite brush could not be used on account of very high resistance and low conductivity, but today we are able to secure brushes for Electroplating Dynamos combining all of the necessary features required for low voltage Dynamos, which are low resistance, high conductivity and self-lubrication.

On account of the low resistance and high conductivity it was necessary to provide a brush composed largely of metal having a high conductivity and at the same time it was necessary to provide lubrication in this brush. By applying such brushes with suitable holders, which allow the brush to adjust itself automatically as it wears down—at the same time holding its proper position on the neutral point of commutation, it not only overcomes the most objectionable feature of the older types of dynamos, which was—as the brushes wore down, they would shift their position on the commutator, and unless they were carefully watched and constantly adjusted, sparking would appear, which resulted in cutting of the commutator—which would soon ruin both brushes and commutator. This has been overcome by the application of the new brush and enables us to furnish machines having a similar brush rigging as are used on larger dynamos and motors of a higher voltage.

Then, again, it not only enables us to build a Modern Dynamo, but practically "Fool Proof" as well. It relieves the operator from

the trouble and annoyance of keeping the brushes properly adjusted as well as properly lubricated. How many of you would feel a burden removed from your daily labors if you possessed a Dynamo like this?

These are not all of the good features contained in Modern Dynamos. With the application of these brushes, we are, also, able to give you a Dynamo with a higher efficiency—one that will enable you to turn out more work per day for the reason that regardless of the amount of work in the tank, your voltage remains constant, and at the same time you are commutating the current at the proper point of commutation, for every dynamo has a neutral point of commutation where the current can best be collected with less losses and no bad results to the commutator or brushes, whereas with the old type of dynamo, it was necessary to adjust the brushes and rheostat at nearly every change of load in order to maintain the proper voltage, but this is often neglected, which results in a light deposit or more time required to turn out the work.

In these days of sharp competition, efficiency in the Dynamo as well as all other parts of the plating room is very essential. If your equipment is up to standard and your dynamo is wanting, you are still handicapped, for you will not be able to turn out the amount of work you should if you had the proper current, so if your Dynamo will give you the voltage as well as the current at a high efficiency, and with all these objectionable features removed, you have all that may be required from the dynamo end of your equipment.

There is still another improvement we have applied to our larger dynamos in what are known as "commutating poles"—sometimes called "inter poles." Commutating Poles have been used for a number of years on standard dynamos and motors of higher voltages. The writer himself has built a number of dynamos and motors equipped with Commutating Poles, and which were a great aid in commutating current on dynamos. These Commutating Poles are somewhat smaller than the Main Poles of the Dynamos, and are placed between the Main Poles and wound with a series winding. These Commutating Poles prevent any possibility of sparking at the brushes from no load to full load and even at a very heavy overload. They do not, however, increase the commercial efficiency of the Dynamo in themselves, but by applying these Commutating Poles in connection with the self-lubricating and self-adjusting brushes—by properly setting these brushes at the factory, which do not require any shifting—the brushes being set at the neutral point of commutation, we are able to give you a MODERN DYNAMO of a higher efficiency than heretofore.

With Dynamos embodying all these features, we have practically reached the climax of perfection in dynamo construction for electroplating or electro deposition of metals, which should be a source of satisfaction to the user as well as the manufacturer of Plating Dynamos.

Newark's Open Meeting

ON Friday evening, December 5th, 1913, Newark held an "Open Meeting" which will be long remembered by those who attended. The foreman platers of Newark and also the manufacturers were invited to attend, and the attendance surely showed that they had accepted the invitation. One of the members started to count noses and grew discouraged with the prospects after he had passed the fifty mark. One of the pleasing features was the good showing made by the New York Branch. Everybody present came in without knocking and the program was so pleasantly arranged that they could not go out any other way. The speakers of the evening were: Mr. Mitchell, one of the Superintendents of Tiffany & Co.; Dr. Jones, of the Celluloid-Zapon Co.; Mr. Fred C. Clement, our Supreme Secretary; Professor Weiner, Principal of the Central High School, and Professor Charles Colton, Director of the Newark Technical School.

Mr. Mitchell's address was entitled "The Relation of Chemistry to the Plater," and his words certainly proved that the study and application of chemistry was surely a great benefit to the plater. The general trend of his statements were that while not desiring to depreciate the work of the theoretical man in any way, the practical man was fully as important, if not more so, than the strictly theoretical man.

Dr. Jones followed with a splendid address upon the benefits of the A. E. S. to the employers. Any employer present who was not convinced that by having his plater join the A. E. S., would not only benefit himself as well as his plater, is certainly at the rear end of the procession.

Both Professor Weiner and Professor Colton spoke upon the value of a scientific and technical education not only to a plater but also to all men in the trades at the present day. Professor Weiner told some stories of the old-time plating, which were not only amusing but also instructive. Professor Colton spoke of how a course in the Newark Technical School had helped several of the members present attain their present positions.

Mr. A. Van Winkle, President of the Hanson & Van Winkle Company, spoke a few words which were well received.

Mr. Fred C. Clement, Supreme Secretary, said that every time he received an application for membership he was reminded of the Bible quotation: "Come unto Me all ye who are weak and heavy laden, and I will give you rest." "This same quotation," he said, "applies to the A. E. S. When a man is heavy laden with the troubles so common to platers, by joining the A. E. S. he will stand an excellent chance of being relieved of his burdens. The medium of being relieved of his troubles is by coming in contact with other

platers, acquiring their knowledge, and also by receiving the QUARTERLY REVIEW. I hope that during the coming month I shall receive many applications for membership from the Newark Branch."

Papers were sent by Mr. Geo. B. Hogaboom, President of the Supreme Body, and Mr. Charles H. Proctor, Founder of the A. E. S.

Paper by Geo. B. Hogaboom

THE American Electro-platers' Society is an organization peculiar to itself. Societies for investigation of scientific subjects have long existed. Organizations whose sole object is to better working conditions and the hours of labor of its members are well known. Each of these societies have accomplished much good; the one broadening out the man through research work; the other creating the desire to share equally with all men the social conditions of life.

There is a wide gulf that separates the members of these organizations; the one being a body of educated men whose thoughts and minds have been trained to investigate and solve scientific problems; the other, a body of men recruited from all classes,—the common bond of artisanship alone, drawing and holding them together.

The members of this Society through the demands of their vocation are eligible to the membership of both of these bodies. The scientific one because their work is along scientific lines and is based upon the principles of the two greatest divisions of science,—electricity and chemistry: the laboring organization, because they are laborers, earning their livelihood with their hands. Neither of the organizations satisfied the longing of the plater. His education, often only that which is received in the plating room, forbid the enjoyment of the scientific treatise of the chemist or electrician. On the other hand, while not against any organization of laboring men, he could not find in their discussions that which would make the solution work well that went wrong the day before. He wanted and craved for the association of his fellow artisans; men who could not alone give the scientific data of a research or a bewildering list of statistics of the laboring conditions at the Tower of Babel, but those who breathed the same atmosphere that he did, who could and would talk about that in which he was most interested—electro-plating.

This was found in the American Electro-platers' Society—a society both scientific and educational; a society of men who labor for a wage; a society of ambitious fellow artisans who realize that the greatest success could be obtained by the development of the latent powers to do things right; a society whose sole object is to better a man's condition by educating him so he can better serve those that employ him.

There is another peculiar desire of this Society, its members want their employers to know what they are doing at the meetings, what the object of the meetings are, and they openly solicit their co-operation and support.

Mr. Manufacturer, they ask you to send your plater to them so they can help him to do better work for you. In return your personal support, both moral and financial, is asked. Words without deeds are of little value. The members of the Society can meet and exchange ideas, enter into discussions and develop a new line of thought, the value of which cannot be tested until the morrow, which so seldom comes in the factory where the production of that which is at hand is of the greatest moment. It is almost useless for the plater to try to solve new problems during the working hours other than those which the daily routine demands.

How much better it would be if he had access to some well equipped electro-plating laboratory, surrounded by men whose years of experience is at their service. Then he could accomplish something, develop and bring forth the finish, the color, which you yourself long wished to possess, something that meant increased business or the satisfying of some good customer.

You can bring these conditions about, you and your plater. There is a thriving branch of this Society at your door. You have been invited to learn from its members and friends the object of the Society and what can be accomplished with your support. The ambition of the Newark Branch is to establish a testing and research laboratory. There are chemists among their members, all they need is the apparatus. Your business welfare should and does need the support such a laboratory can give. Do something toward its establishment and be the greater recipient of the good derived from the results of broadening and educating the plating fraternity of Newark. Another thing, see that your plater is an active member of the Branch. Show him that you are interested in him and he will be interested in you and your work.

Paper by Charles H. Proctor

Mr. President, Members and Guests of the Newark Branch of the American Electro-platers' Society:

It gives me great pleasure this evening to say a few words to you on the Conception, Formation and Objects of the American Electro-platers' Society.

Looking backwards more than a quarter of a century to the time when I first became connected with the electro-plating industry, and the many changes that have taken place during that period seems to be more like a dream than a realization of facts. The conception of

the American Electro-platers' Society was a dream of long years ago and a dream that I hardly expected to ever see realized, but we all know that dreams sometimes come true. How many of the wonderful discoveries in science, art and industry had their conception in day dreams or in the silent hours of thought. If these dreams had not come true all the wonderful discoveries that have been brought forth during the past quarter of a century, which have so enriched the world and made the sum total of human knowledge greater than ever before in the world's history, would have been only a dream instead of a realization of actual facts. We are so accustomed to new wonders that any great invention or scientific discovery causes but a ripple of excitement and in a few days or weeks belongs to the past.

Very few platers or guests here this evening realize that all the wonderful developments in electric motive power, electric lighting and many other achievements, besides the wonderful production of many notable chemicals from the air by the aid of electrical energy, had their origin in the latter part of the eighteenth and the early years of the nineteenth century by the early investigators in the transmutation of one metal to another. From the evolution of these experiments can be traced all the wonderful electrical developments of today, and which makes the art of electro-plating sponsor for the untold millions of wealth which has been obtained from these wonders of electrical energy that up to the present time have not been scientifically explained.

Like many other young men who took up the art of plating nearly thirty years ago, my practical knowledge was gained by many sleepless nights and troubled days. How often I wished in those days that I had some friend with greater experience than myself that I could go to for information and friendly advice, but no plater was in my immediate vicinity and then, in calmer moments, I realized that to ask for information would only prove that I did not understand my business. There were no trade journals then and the text books were very limited and had not then taken up the new conditions created with the advent of the dynamo and so the years went by. Yet in those years how often I had dreamed that perhaps some time the electro-platers of the United States would get together, and that some day they would have an organization of their own where they could meet together and discuss the difficulties that so frequently occur. Even the impression that the thought left upon my mind seemed to relieve the tension in times of trouble and distress. I talked with many platers during after years of the advantages that would accrue by an organization, whereby all could meet at some appointed time in various commercial cities and thought what a grand thing it would be to exchange experiences and tell of our difficulties. They could not or would not see the advantage and finally I decided to take up the battle myself and commenced to lay my plans for the future.

In May, 1908, at the convention of the American Iron Founders' Association, held in Philadelphia, the American Brass Founders' Association (which is now the American Institute of Metals) came into existence. At that time a paper was read by your humble servant upon electro deposition of brass. While this paper was somewhat foreign as a subject for a brass founders' convention, still I had an object in view. In concluding my remarks I bid them God Speed and stated that as the birth of American Liberty occurred in Philadelphia it was well that the birth of the American Brass Founders' Association should occur in that city and I trusted that in the near future another organization might have its birth there. I referred to a national organization of electro-platers of the United States and Canada. Upon discussion I was appointed a committee of one to interest electro-platers so that they could become affiliated as a branch of the American Brass Founders' Association, but I found that platers did not take kindly to this idea and finally, I abandoned the thought of affiliation with the Brass Founders' Association. Yet the idea had given me a new impetus, so I commenced at frequent intervals appeals to the platers of the United States through the columns of *The Metal Industry*. These appeals brought forth answers and promises of financial assistance and finally, in April, 1909, a meeting was arranged for at the Astor House in New York City. After several meetings an organization was decided upon to be known as the National Electro-platers' Association of the United States and Canada. As soon as the organization was formed the membership began to grow and the association was chartered under the laws of the State of New York in June, 1909.

The Association, like many new organizations, had internal differences which sometimes seemed as though it would wreck the association upon the shoals of dissention. Finally harmony prevailed and right triumphed, and the association steadily grew. Soon after a branch was organized in Philadelphia, and in rapid succession came Chicago, Toronto (Canada), Detroit, Dayton, Cincinnati, Rochester, Indianapolis, Milwaukee, St. Louis, Newark and Buffalo, and the membership is continually increasing in all these branches.

In the latter part of the year 1912 it was decided to give each branch equal representation and, as this could only be accomplished by a separate body, a convention was called to be held in New York City, February 1913. Representatives from all the then existing branches met, and at this convention a governing body was created and the name of the association was changed to the American Electro-platers' Society. Mr. George B. Hogaboom of your city, one of the most active workers in the formation of the Society, became the first Supreme President. The second convention of the American Electro-platers' Society will be held at Chicago in June, 1914.

Thus from a dream of early years came the final realization of an organization that I trust will play an important part in the

development of the great commercial interests of the United States and Canada.

I have been frequently asked in the past two or three years what was to be gained by membership in the Society. Many of you present this evening who are non-members have probably gleaned from remarks that have been made some of the advantages to be gained. The others are: mutual assistance, discussion of the latest phases of the art, the organization and maintenance of a laboratory for experimental purposes, ways and means whereby methods may be improved and cost of production lowered, fraternal and social features which all help to make the organization valuable to its votaries. The American Electro-Platers' Society is strictly an educational one. It has no affiliation with any other organization excepting those promoting higher education. It has been recognized by the American Electro-Chemical Society, whose membership covers the entire world, and in April of this year it met with many notable men of the American Electro-Chemical Society at Atlantic City, N. J., in a symposium of electro-plating, from which much value to the art of electro-plating we hope will accrue.

At the Eighth International Congress of Chemists, held in Washington, D. C., in September, 1912, I had the pleasure of meeting some of the officials of the Bureau of Standards, and the development of electro-plating was taken up at that time. I feel sure the Bureau of Standards will gladly co-operate with the American Electro-platers' Society to create standard formulae that can be used and relied upon at all times. This will prove to be an important step in the right direction.

The Newark Branch extends to you a cordial invitation to become one of its members. I am sure when you realize its benefits you can no longer withhold your membership. Mr. Manufacturer, see that your foreman plater becomes a member of this society because we believe it will be to your interest and his, not only for his own welfare but as an honor to your beautiful city of Newark, one of the workshops of the world and a benefit to the great commercial interests of this country, of which you are an integral part.

I am exceedingly sorry that I am unable to be with you upon this auspicious evening, but my thoughts will be with you and my best wishes for the success of the evening will be a solace and inspiration for the future that, even as a dream, brought forth the existence of this society of which you have the honor to be a notable part.

Electric Conductors from Dynamo to Plating Tanks

JOHN NELSON.*

THE round bars and connections have always been a source of trouble. I believe that I have found a better way and hope that a description of same will be helpful to fellow platers.

We all realize the need of a steady reliable current in the plating tanks at all times, and in order to insure this we must have a reliable dynamo of ample capacity running at a steady speed.

We must also have conductors of ample conducting capacity connected in such a manner that they have good contacts and will not work loose where they are joined together. Other factors to take in consideration are first cost and convenience in case changes are to be made that require alterations. The principal feature of the construction that I prefer is bars of a rectangular cross section fastened together with 2 bolts, for a cross section of $\frac{1}{2}$ inch I prefer a bar $1" \times \frac{1}{2}"$, and $\frac{1}{4}" \times 1\frac{1}{2}"$ bolts for holding same together, with the $1"$ surfaces against each other. Brass or iron bolts may be used with equal satisfaction. If iron bolts are used, however, some oil or grease should be put on the threads so as to prevent rusting, which makes it hard to take them apart should this become necessary. I prefer to use bars of like cross section connected in a similar manner between the main conductors and the tanks; but should round bars be at hand and it is desired to utilize same this can readily be done by bending the ends to form loops through which the bolts may be passed. For anode rods I prefer bars of a rectangular shape with a ratio of 1 to 2 fastened to the tank by brass wood screws so that the top of the bar is flush with or below the top of the tank. To this bar the anodes are fastened by means of bolts with nuts or the holes in the bar may be threaded and thumb screws used for the sake of convenience should it be necessary to remove the anodes.

When this method is used the anodes will require no attention as far as connection is concerned after they have once been properly fastened. It is obvious that this method of connection will do away with the customary cleaning of the anode rods. When sheet metal anodes are used a strip double the thickness of the anode should be riveted to it for fastening same to the bar, the entire anode should be submerged in the solution so as to reduce the anode waste to a minimum.

In places where there is considerable vibration and the ordinary connections work loose the square bars bolted together will eliminate this trouble, dirty connections requiring attention and broken set screws will be unknown and when alteration or new constructions take place you will not find yourself with a box full of fittings, which do not fit.

*Chicago Branch.

The Electric Cleaner

C. S. WEYGANDT.*

SO much has been said about the electric cleaner that I am inclined to believe the members of the A. E. S. have heard about all they care to hear either for or against the use of this method of cleaning polished articles preparatory to plating. However, there may be a few platers who could use the electric cleaner and obtain very satisfactory results but through fear of failure or lack of room are cleaning by scrubbing with a brush and pumice or some other gritty substance. This way of cleaning preparatory to plating we must admit will enable the plater to plate large quantities of work, avoiding all manner of peeling, providing conditions otherwise are correct.

To the platers who are not using the electric cleaner and are still worrying along with scrub brush and pumice, I will say your polished work can be cleaned by the electric method and properly plated with the per cent. of peeling so very small that you will wonder how you ever got along without it.

In the polishing department the trimming for the stoves undergo the process of polishing. The kind of finish desired is a matter left to the management. The more time allowed the polisher the higher the finish should be. Under the old method of cleaning the highly polished articles are tumbled into dipping baskets and immersed in boiling potash, from the potash tank they are put into water, and then the process of scrubbing this highly polished surface takes place. We spent much time and money to put on as nice a lustre as existing conditions allow, and then we use a brush and some gritty substance as though it were intended the lustre put on by the polisher should be removed before the article is to be plated.

By hooking, stringing or racking the highly polished castings as if they were to be plated without any cleaning, the extra wiring before immersion in the potash tank is eliminated, denting and marking by handling is lessened, and the lustre put on by the polisher is more readily maintained. The scrubbing with any gritty substance before plating materially assists in removing at least some of the lustre. After a sufficient number of pieces are hooked or racked they can be hung in the cleaner and in a few minutes a plating tank will be ready to receive the current.

The size of the tank to be used must be determined by the amount of work to be handled. It should be placed so that work can be put in and taken out from either side. The branch wires from the main conductors should be large enough to carry the current so there will be no resistance and the cleaner will be receiving all of the available current. An immersion of from one to three minutes is sufficient.

The results of a test of amperage used may be of interest to and perhaps assist platers not using the cleaner in determining the amount of current necessary. An ammeter connected to a cleaner tank was carefully read, the pieces cleaned being of various sizes and shapes. The total amperage required to clean 1832 pieces was 15,572, or an average of 8.5 amperes per piece. Six pieces of 18 guage unpolished sheet steel, each sheet measuring 1 foot by 2 feet, containing a total of 36 square feet of surface, required 300 amperes or an average of $8\frac{1}{3}$ amperes per square foot. The voltage used varied from 5 to 6, the variation being due to a variation of the speed of the motor driving the plating dynamo. The tank used to make this test was 8 feet by $2\frac{1}{2}$ by $2\frac{1}{2}$ and contained about 320 gallons and was connected so that the reverse current was being used. Stove work was used in making this experiment and the sizes of the pieces varied from the smallest to the largest to be plated at the time.

Platers contemplating the installation of a cleaner should make a test of amperage used in the plating tanks under full load. If the plating dynamo is not capable of generating more amperage than is needed in the plating tanks, a larger machine will be necessary or one should be installed to be used for the cleaner only.

Failure to meet with any degree of success with the electric cleaner may be attributed to a lack of sufficient current, and to the manner in which the articles to be cleaned come from the polisher. A dry, clean finish is necessary. Then it must be shown that there is sufficient power. If the required amount of amperage is available and the articles to be cleaned are finished as they should be, the electric cleaner will work properly on all cast iron and steel. Pieces finished too greasy, and those with emery cake stuck in the grooves and on the surface will not come out clean, and such pieces are very apt to peel.

The electric cleaner will be an additional load for the perhaps already overloaded plating dynamo, therefore a tank not too large should be installed to begin with. A tank 6 feet long and 2 feet wide and about thirty-four inches deep ought to answer for the smaller stove factories, say those that employ from 12 to 20 polishers. Equip this tank with one pole for the pieces to be cleaned, using the current either direct or reversed and if sufficient power is available a very large amount of work can be cleaned. After removing the articles from the cleaner they should be rinsed thoroughly in clean, cold water, dipped into an acid dip and then rinsed in running water, when they will be ready for the plating tank. If any peeling should be encountered it can in most instances be ascribed to improper finishing by the polisher and not imperfect cleaning by the cleaner.

To assist in handling the work for the cleaner a little rearrangement may be necessary. A post, say 16 by 16 inches, can be placed at a convenient distance from the cleaner tank and plating tanks. Arms made of gas pipe can be fastened to this post in such a way

that they can be swung back and forth. Around the post build a circular table or bench from which the hooking and racking can be done. A sufficient number of hooks and racks should always be available, and they should be hanging assorted so that any particular hook or rack can be reached instantly. If the tank is deep and wide enough the cleaner will work very well on all classes of stove work. The connections to the tank can be made so that they can easily be changed, that the current can be used as desired, either direct or reversed. A little experimenting along these lines will soon enable the operator to determine which method is producing the best results.

Platers of stove work will find the electric cleaner indispensable. There may be a few large pieces that may be cleaned by scouring with brush and pumice. If the tank is deep and wide enough, the wires connecting it to the main conductors heavy enough, there will be few failures on the larger pieces and all of the smaller ones will come out clean. If a few pieces are found that the nickel will not adhere to properly, the fault should not be placed on the cleaner. There probably were a few pieces peeling now and then before a cleaner was being used. There was then some faulty condition somewhere that had to be corrected, and if there should be any peeling while the cleaner is being used the cause of it should not be placed on the cleaner until all other conditions are corrected.

*St. Louis Branch.

One of the Indianapolis platers had a copper solution plate brass upon the addition of carbonate. Investigation by the chemist for the Branch showed the presence of varying amounts of nickel in the carbonate. The nickel was removed by running heavy work in the bath as white as possible until the deposit regained its normal color.

Sore Hands and Sore Heads

J. C. DAVENPORT.*

FOR years the writer suffered all the torments of cyanide sores, especially on the hands. I would use salves, lotions and various other remedies recommended and prescribed by physicians. Just think of it, a plater going to a doctor for such troubles! Yet in my egotism I did not dare go to a brother plater as I was using every ounce of my energy trying to make them think that I knew everything that was to be known about the plating game. Well, I just kept on with my hands so darn sore that at times it was agony to button my clothes much less to do my regular work. I felt that I was a martyr to the cause and of course that got my head sore, too.

I could have asked any of the old platers, and I have no doubt but what they would have gladly helped me. But I didn't. I was afraid that they would get on to me and consequently had sore hands, sore head and sore at the world in general just because I was too narrow-minded to ask a simple question.

At last Mr. Wm. E. Burns, an old retired plater, told me the old, old remedy. You can bet that I did not let him know that this remedy was new to me, that he was doing me a favor or that he was telling me anything I did not already know. In case any of you are as foolish as the writer was and have sore hands, due to cyanide, just try the remedy Mr. Burns told me.

Get five cents worth of fish oil, wash hands thoroughly in warm water before retiring, rub in the fish oil, slip on an old pair of cotton gloves and in the morning the soreness will have disappeared. It has certainly done the work for me.

But the remedy for sore heads, after you have decided to take the cure is: Don't be afraid to go to a brother plater with any of your troubles. You will find lots of good fellows in the game, nearly all of whom are members of the A. E. S. If they are not, tell 'em about it, how we are a "little bunch of sunshine in times of trouble." How we don't know it all, but we are trying to learn and want them to help us.

Now, say! Ain't it something scandalous how short a time it takes some of us to tell all *we really do know*. We have found that out since our branch has got started. Oh, well, the writer can honestly say, "I am proud of the fact that I'm one of you and am striving with the rest of you to get a better understanding of the two greatest things: Chemistry and Electricity."

*President of Indianapolis Branch A. E. S.

Production of Various Colors

L. C. O'DONNELL*

A GOOD many of you have doubtless seen the beautiful effects on statuettes having a fawn color on the arms and limbs, with a green verde in the folds of the clothing. The method of producing this finish is described herein:

SOLUTION NO. 1.

Water	1½ gallon
Copper Sulphate.....	25 ounces
Oxide of Iron, Red.....	¾ ounces
Ammonium Chloride.....	¾ ounce

If the castings are of any metal other than solid copper they must first receive a heavy deposit in the acid copper solution. Brass cannot be done with this formula. The face, arms, limbs, etc., must be buffed and the clothing and similar parts may be bright dipped. They may also be brushed or sanded and cleaned thoroughly. Immerse in Solution No. 1, use boiling hot, for about 20 seconds, rinse in cold water and a quick dip in a solution composed of one gallon of water and six ounces of ordinary lime, which is also used hot. The casting may then be immersed for one-half minute in Solution No. 3, which is composed of five ounces caustic potash dissolved in one gallon of water and used hot. The casting may then be dried in the usual manner.

After having been dipped into Solution No. 3 the casting will be covered with a fine yellow powder which rubs off easily showing up the desired fawn color. If the acid copper is giving a nice smooth deposit the casting may be rinsed in water and treated in the manner described and good results can be gotten. The casting is then brushed lightly with a plater's hand brush which will bring out the even color. Lacquer with a good transparent lacquer and give it a coating of wax which is made by simply melting bees-wax in turpentine. Brush again by hand and the beautiful fawn bronze with an egg shell finish will have been obtained. The last operation can be done with a very soft buff running at a low speed and the wax finish can be done with a goat-hair brush. By varying the amount of Ammonia Chloride used, different tones may be obtained. In handling the castings care must be taken not to touch the finish until after the article has been lacquered as it is a very delicate finish and easily spoiled. Nine or more coats of lacquer will give the figure an onyx appearance. The verde in the folds of the clothing is

put on before lacquering and can be produced by using the following formula:

Water	1	gallon
Copper Sulphate	9	ounces
Ammonium Chloride	9	ounces
Sodium Chloride.....	3	ounces
Acetic Acid	2 1/2	ounces
Zinc Chloride	1 1/2	ounces
Glycerine	3/4	ounce

Apply luke warm with a pencil brush.

In producing colors on brass goods it is surprising how many colors can be derived from the use of the Sulphuret Solution and Muratic Acid dips. I have tried to work out a table for producing these colors which may be interesting. In using this table first immerse the articles in the quick dips, rinse in cold water, dip five times in the muriatic dip, rinse and immerse thirty times in the sulphuret dip. Repeat and work on down the table:

Sulphuret of Postassium Solution. 2 oz. to each gallon.	Color Obtained.	Muriatic Dip.		Color Obtained.
		1	fluid oz. to each gallon.	
30 dips into above	Tarnished brass	5 dips into above		Golden brass
Followed by above	Deeper tone	5 dips into above		Irridescent and deeper tone light brown
Followed by above	Brownish tint	5 dips into above		Beautiful bluish brown on higher lights, br.
Followed by above	Bluish brown of deeper shade	5 dips into above		Slate green
Followed by above	Brownish green tone	5 dips into above		Deeper tone
Followed by above	Brownish green tone	5 dips into above		Brown with purple sheen
Followed by above	Foregoing color of lighter shade	5 dips into above		Blue and brown shade deeper tone
Followed by above	Blue and brown	5 dips into above		Same tone, but deeper
Followed by above	Still deeper tone	5 dips into above		Blue-black
Followed by above	Blue-black	5 dips into above		Deep blue-black

The colors can be brought to an even finish by scratch-brushing lightly.

* Newark Branch.

Wanted! Reward Offered.

More articles for the next QUARTERLY REVIEW. The reward consists of the thanks of the Editorial Staff and the appreciation of the entire Society.

Electrolytic Assaying of Plating Solutions

CHARLES A. STIEHLE*

IN all text books we are told that in order to make an electrolytic assay of a plating solution a platinum cup and anode is necessary. Inasmuch as the price of platina is very high, there are consequently very few platers or employers willing to purchase the necessary apparatus. I have made the assays, however, and the results were very good, there being a difference of only .03 to .08 pennyweight in several tests of the same solution.

The cups I used were of ordinary brass spun up in the shape of a whiskey glass and holding about two ounces of solution. They were lightly nickel-plated to prevent their being attacked by either acids or cyanide. For the anode I used a piece of ordinary electric light carbon which had not been copper-plated.

To make the assay first measure out one ounce of the solution you wish to test, put it into the cup which has been carefully weighed on a balance which is sensitive to at least one grain. The cup must now be connected to the negative (—) pole of your dynamo and the best way to do this is to connect a flat piece of copper to the negative pole of the dynamo and allow the cup to rest upon it. Now connect the carbon to the positive (+) pole and hang it into the solution in the cup, thereby making the cup the cathode (—) and the carbon the anode (+).

The current strength to be used should be from $1\frac{1}{2}$ to 2 volts at the beginning but should be increased to 4 to 6 volts at the latter part.

The complete analysis of the metallic content of the solution will take from three to four hours and by the end of that time all the metal in the solution will be plated out upon the inside of the cup. As soon as the operation is completed, disconnect the current as quickly as possible, pour out the contents, dry and reweigh.

Supposing the original weight of the cup was 10 pennyweights and the second weight was 10 pennyweights and 12 grains. This would show that one ounce of the solution contained 12 grains of metal. As there are 128 ounces to the gallon, $12 \times 128 = 1,536$ grains or 4 ounces and 3 pennyweights of metal to the gallon.

*Newark Branch.

Nickel Solutions

ROBERT SUMAN.*

THIS being one of the first articles brought before the Dayton Branch, I will try and discuss one of the most commonly used solutions in the plating industry. I will also try and start an argument with the idea of getting views, as we all have our own particular ways of doing things. I think that it is best to start on one particular solution or formula and discuss it thoroughly.

Let us first discuss nickel deposits. It is a pretty difficult task to start one on any particular job or solution without his knowing what he has to contend with. For instance, a plater may only have one tank and in this one tank must be plated iron, brass, copper and zinc. It may be that he shall have to plate on one metal only. For depositing on such metals as brass and copper he may keep his solutions nearly neutral, neither acid nor alkaline. But if cast iron or steel is to be plated there is a tendency to carry acid into the solution which must be removed by ammonia or another process of which I will speak later on. Generally speaking, one must adapt his solutions to his particular line. By this, however, I do not mean that you must have a different solution for each metal to be plated.

The argument may be started by one plater saying that he has the best nickel solution on the market. Another will state that he has the whitest background. Still another will state that he uses this for a brightener and that for a conductor. And so the various arguments arise. Some have added nothing to their solutions for months and others have added double salts only. This simply proves that we all have different methods of management. I have had considerable experience with various nickel solutions made and "doped" by different platers and am thoroughly convinced that the less a solution is doped the less trouble will be had with it. But sometimes a solution must be doped. For instance, you may take charge of a plating room and nothing is known about the various conditions. Without doubt you are anxious to find out the condition of your solutions and therefore test them first by the hydrometer and then by litmus paper. The hydrometer may register 7° or 8°, but that does not prove that there is sufficient metal in the solution. The high standing of the hydrometer may have been caused by the addition of conductive salts. You would try to plate and possibly get a slow deposit which would not hold. A dark and cloudy deposit may be gotten which would lead you to think that it has been burned. But inasmuch as the whole deposit is dark it could not possibly be considered a burn. I myself came across this condition at one time and was at a loss to know the reason of this condition. I asked the helper where the previous plater had kept his acid and he pointed out an 8 oz. bottle of nitric acid which was empty. The helper then stated that on the day the previous plater had left he

(the plater) emptied the entire contents of the bottle into the nickel tank. That, of course, cleared matters and I then proceeded to neutralize the solution and gave it a good stirring up. After the solution had settled I added some nickel salts and a splendid deposit was obtained.

Work may be burned upon the ends and points, the reason being an over-supply of acid or a deficiency of metal in the solution. When the deposit is velvety on the ends and points of the cathode the cause may be attributed to the presence of too much free acid. A heavy deposit may be obtained which would not hold and would peel off under the buff. This would indicate that your deposit is soft and has been deposited too fast. A deposit may look good in the solution but after the work has been run the required time the deposit has been found to have been too light. This would indicate that your solution may be O. K. but that there has been a poor electrical connection somewhere. Possibly the solution is poor in metal contents.

A great many platers may say that I have never had any troubles of this kind. If any plater has not had any troubles of this kind it may be safely said that he has not done very much nickel plating, and if he were to start in these troubles are almost sure to arise.

Below are some of the questions asked in a previous quarterly review. Also the answers.

I.

Question—At what voltage do you run your nickel?

Answer—I run my still solutions at 2-2½ volts. In barrel plating the voltage varies.

II.

Question—At what degree Baume does your solution stand in winter and in summer?

Answer—I keep my solutions between 6° and 7° the year round and always get a fine and even deposit. Some platers prefer a heavier solution in summer but I cannot see any advantage in this.

III.

Question—Is sal ammoniac good for solutions?

Answer—Only for conductive power.

IV.

Question—Is boracic acid good?

Answer—That depends. If you do barrel plating and wish your work to come out bright, a little boracic acid may be had. It may also be added to still solutions but I do not approve of it.

V.

Question—Do you add single or double salts?

Answer—I generally use the double salts and find that it is the cheapest in the long run.

VI.

Question—What is your opinion of a brightener?

Answer—In some cases sulphuric acid will do and in others boracic acid should be used. Bicarbonate of soda may be used in small quantities and is a good brightener.

VII.

Question—How do you correct too much acid or not enough?

Answer—If not enough acid I use sulphuric acid. Sometimes the addition of double salts will do.

If too much acid I use bicarbonate of soda in small quantities. Some platers will doubtless say, "Why use soda?" My experience has been that by adding soda you neutralize the free acid forming carbonate of nickel and sodium sulphate which is a conductor and does not harm the solution. It also gives a white deposit. As soda is very soluble it can easily be added to the solution and you can work your solution immediately. I have been using this for the past twelve years and have never experienced any trouble by its use. It must, however, be used in small quantities as an excess will soften the deposit.

VIII.

Question—How long do you run iron and brass?

Answer—Iron can be run for one-half hour but one hour's deposit is much better as a closer grain can be gotten which will finish up better. Brass can be run for a shorter length of time.

IX.

Question—Have you any way in which to determine the amount of nickel in the solution?

Answer—An idea may be had by the time required for a good deposit and also by the color. It can be determined by a chemical analysis of the solution.

X.

Question—What kind of anodes do you like?

Answer—I prefer the bottle-shaped anodes as there are more points of contact to be drawn from.

There could be a great deal more said regarding the deposition of this metal and I would be pleased to hear from some of the other platers regarding this subject.

*Dayton Branch.

"Yes," said the old man, "I've had lots of trouble in my day but most of them have never happened."

Economy in the Plating Room

H. A. GILBERTSON.*

SOME years ago there came to my attention the gross waste of certain manufacturers through their employing inexperienced help in this most important part of their business.

One concern made quite a variety of metal goods, a lot of which was gold plated. The gold solutions after being used a while became off color, and were then emptied into the sink or sewer, although they were richer in gold when thrown away than when they were first made up. This waste alone amounted from \$75.00 to \$250.00 a month, all of which could have been saved with but little time and expense.

Another concern which was manufacturing jewelry was doing the same thing, but they were not aware that they were not saving the gold, as they had a jewelers' wash-out bench with settling tanks underneath, which they supposed was saving this gold. It was not, because these jewelers' wash-out settling tanks do not save the gold which is in solution as they only save that which is in a metallic state. Owing to its specific gravity the gold settles to the bottom while the lighter substances pass over. It was not only roman gold solutions which were wasted, but rich strip solutions which were used in removing the fire coat from jewelry which they manufactured.

Another concern was in the habit of selling their polishing room sweepings with all the old gold solution that had accumulated at \$32.50 a barrel. When they had a barrel of sweeps filled, they would pour on the old gold solutions. In about the time that a barrel of polishing room sweeps had accumulated, I took from these old gold solutions \$112.00 in gold, and we still got \$32.50 for the sweep. Finally the refiner after getting several of these barrels, called on the proprietor, and complained that the barrels were not so rich as they formerly were, but as he did not refuse them, evidently he was not losing anything on them even at that.

These are only part of the material waste. There are many more, for instance, the buffing waste. If this waste is collected it will more than pay for the operation and maintaining of the exhaust system in many factories where gold and silver is buffed. This waste is sent to the sweep refiners who burn the same and remove the materials very economically.

Then there is the wire from work which has been plated. If it is covered with silver, it may be dissolved in dilute nitric acid, and the silver may be precipitated from this by adding hydrochloric acid or salt solutions until the precipitate ceases to form, when the solution which contains the copper may be removed by decantation, and the precipitated silver chloride washed, dried and melted. Wire which is covered with gold may be dissolved in aqua regia and diluted

with water and the gold precipitated with ferro sulphate. The precipitate is then washed, dried, and then melted, or the wire may be stripped in a solution of cyanide and phosphoric acid.

Regarding the saving of gold in old gold solutions, will say that the way I do this is to hang strips of zinc in the gold solutions. This will precipitate all the gold that is in the solution. The solution is then emptied, and the zinc and gold residue dissolved in hydrochloric acid, or if copper and silver be present, dissolved in nitric acid. This solution will contain all copper, silver, zinc, lead or iron which may be present, and the precipitate will contain the fine gold as a metal. This powder may then be melted in a sand crucible with sodium bicarbonate or borax.

*Read before Chicago Branch.

Historical Sketch of Electrical Theory

By R. M. DAVENPORT.*

THE word ELECTRICITY is derived from a Greek term meaning AMBER, which substance was observed to attract light bodies when rubbed. This observation appears to have been first recorded about 600 B. C., which indicates that electrical phenomena are by no means a recent discovery. But while the phenomena have been known for centuries, even the simplest of them are by no means fully explained today, and most of us who employ electricity every day are absolutely ignorant of its nature.

Electrical theory has had a slow and round-about development; starting with the idea that it was a fluid, then regarded as two fluids, later considered not as a *thing* at all, but as a *force*—electricity has come to be held more recently as the motion of extremely small particles of matter.

Up to the time of Galvani and Volta, "frictional" electricity, so called because developed by friction, was the only form of electricity known. About 1750, Galvani, an Italian professor of anatomy, discovered what he called "animal electricity" in the course of some experiments on frogs' legs. He found that the muscles of a frog's leg "kicked" when suspended from an iron railing by a copper hook, and wrongly assumed that the frog's leg was possessed of an electric charge. A few years later, Volta, also an Italian, proved that the remarkable performance of frogs' legs was due to the contact of iron and copper in salty water, and about 1800 he built the first battery from discs of copper and zinc, separated by acid-soaked cloth discs. The production of a current or flow of electricity upset all previous ideas based upon the transference of electricity by sparks, and it began to be thought of as a force.

The next great advance came in 1831, when the immortal English scientist Faraday succeeded in transforming magnetism into electricity and proved the relations of these two effects. Upon this discovery are based all our present-day developments of motors and dynamos. It was Faraday who, in 1834, discovered the fundamental laws of electrolysis upon which all electro-plating operations are based, and only four years later the laws found application in actual electro-plating work.

The last century has seen a marvelous development in all commercial applications of electricity, but not until within the last ten years has its theory changed greatly. Recently through the wonderful work of a group of English scientists, we have come to believe that electricity is a form of matter—in fact that matter *is* electricity, and nothing else. We are on the threshold of a new era in physical science and the next century will afford a closer insight into the real meaning if not only electricity, but, through it, into the eternal riddle of the composition of matter and the transformation of energy.

Through the many clear and simple magazine articles and easily read books, it is possible for any of us to follow these wonderful discoveries, and it will pay us in every way to keep in touch with them.

*Member of Detroit Branch A. E. S.

The Editor recently asked the reason why a certain Branch did not contribute to the QUARTERLY REVIEW. "Well," was the reply, "the boys really would like to write up articles but they seem to think that they have forgotten their grammar and rhetoric." Hang the grammar and rhetoric. No good plater uses good grammar. Send in your article to one of the Editorial Staff. Never mind how badly it is composed. Send in facts and information and let the Editorial Staff furnish the trimmings. They will do it willingly and cheerfully.

American Electro-platers' Society

(An Educational Society)



Chartered 1909

QUARTERLY REVIEW

JUNE-JULY-AUGUST, 1913

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QUARTERLY REVIEW

American Electro-platers' Society

(An Educational Society)

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No. 1

Editorial

They are a voice of the past,
Of an age that is fading fast.
Out of the shadows of night
The world rolls into light;
It is daybreak everywhere.

THE time was not long distant when the plating world was enclosed in the deepest shades of night. Platers were jealous and unfriendly to one another; each one carefully guarding the portion of information he had relating to his craft; but that age has come to its end. Daybreak came when the National Electro-platers' Association was formed. It was not an easy task to break down the barriers that were put in the path of the organizers of this body, but by grit and perseverance the barriers were at last broken down. The American Electro-platers' Society is now rapidly coming into the full sunlight of its existence. It is fast being recognized as one of the leading educational societies of the world.

Ours is the duty and privilege of holding it up to the high standard which has already been set. The only way to hold it up to this high standard is by clear, liberal, broadminded thinking, aided by plenty of good honest work. Narrowmindedness and secrecy among the members themselves is to be frowned upon. No one should have joined this society whose intention it was to have absorbed all the benefits to be had and give none in return. Let us be liberal in our knowledge to one another. Let us work hand in hand, shoulder to shoulder, pushing that which is for the good of the society and throwing away that which will not advance it, even though it may go against our grain personally.

If we will but faithfully strive to live up to these ideals, the future of the A. E. S. is assured. It is up to you and me, individually and collectively, to be faithful in this and being faithful in this one thing we shall be made the masters of many.

THE EDITOR.

Address delivered before the Dayton Branch by former President Richard H. Sliter

Mr. President and Gentlemen:

It is always a pleasure for me to speak about the development of the American Electro-platers' Society. Its growth has been greater than the fondest hopes of its organizers and the promise for the future is so bright that I hesitate to predict it. To think that in February, 1909, a mere dozen platers met in the Astor House in New York City, and from that meeting there is now as many Branch Societies in as many cities as there were men in the first meeting. To say such a growth is marvelous is but feebly expressing it in mere words. Only one who knows the peculiar characteristics of the plater can comprehend the greatness of this movement.

You all know what a peculiar being the average plater is. He has tried to live to himself, hoards his knowledge as the miser does his money, and regards with suspect anyone who wants to know anything about electro-plating. The knowledge of the game was obtained in piecemeal, often attended with sleepless nights; it was gained through the perseverance that demanded secrecy as its reward. To give up any of this hard-earned knowledge was not to be thought of, not even in dreams. An exchange of formulas would be negotiated with the same care as such a transaction in gold bonds. Even more so, as often the knowledge sought was thought far inferior to that given in return.

When the few platers first met that feeling predominated, and it was not until three meetings were held that an organization was affected. The platers began to realize that the other fellow was as clever and knew as much about plating as he; he found that by talking plating the atmosphere was changed, a warmth of comradeship prevailed. The exchange of ideas was fascinating. Little points, heretofore not thought of, were mentioned, discussion brought views from several different angles and the plater went away from the meeting feeling that he had mutual friends whose knowledge and new ideas gave a new life to the everyday humdrum.

Like with everything else, there were some clouds; some who saw in the gathering of men of one trade an opportunity to control the working conditions. The agitator was not escaped, but fortunately the society weathered the storm and the principles of education were triumphant and the question of labor conditions and wage was forever barred from discussion.

With the education of its members as the only object of meeting together the Society began to grow. The idea was new and startling. To think that men of a certain craft were to meet together to ex-

change and develop ideas, to broaden their knowledge of the trade through intermingling with one another. The idea was contagious and from all parts of the country inquiries came concerning this new line of bettering the craftsman. Education had done much for the youth of this great country and why should it not do as much for the plater.

It has, and to-day there are branch societies in twelve cities, eleven in the United States and one in Canada, meeting monthly or semi-monthly, all banded together under the head of a Supreme Society and chartered under the laws of New York State, the mother state, for "educational purposes."

This Society has been recognized by such scientific bodies as the American Electro-Chemical Society, by large universities and by men of much learning in the scientific world. Three of the branch societies, Toronto, Rochester and Milwaukee, hold their meetings in universities and have the assistance of the instructors in directing the educational features of the Society. Other branches have engaged electro-chemists to give them instructions once or twice a month, and one branch has a large sum of money ready to purchase an outfit for a laboratory in which to conduct experiments.

What other organization of men of any one trade has made greater advances in educating their members? And to realize that this Society is only four years old, an infant in years, but the man of full growth in stature and progressiveness.

To you gentlemen here is it necessary for me to say more? Over six hundred actual foremen platers, and remember that means only one man from a factory, whether they employ a hundred or thousands, are members of the American Electro-platers' Society. This in itself is a strong indorsement of the movement and you must realize what that means. In a short time, a very short time, to not be a member of the A. E. S. is to be a confession that you have not laid aside the cloak of the alchemist, but that you still are groping in the narrow tracks you have beaten around your tanks, borne down with heavy thoughts that you are "alone up against it"—a hermit in your trade.

To become a member you come out in the open light, seeking the knowledge that will lighten your burden. Being a man among men, giving and receiving, making your labors a pleasure, crowding doubt and uncertainty out of your lives and learning that "fellowship" in a trade is as great as "fellowship" in a purely fraternal organization.

Odds and Ends about Cyanide Plating Solutions, their Care, Composition and Conduct

By F. J. Liscomb.*

MANY books and papers have been written about copper, brass and bronze plating solutions. These articles generally begin with new chemicals, then tell about the color of the deposit, sometimes at what voltage to work the bath, and end by saying that if it does not work "so and so" to add "so and so," leaving the poor plater to flounder around and guess at what happens in the bath while in actual operation.

The thought occurs to me that perhaps the description of a few experiments will start the members of this association on a tour of investigation. If it does, the results are certain to be beneficial.

Copper and brass are deposited electrically on all metals as a means to an end.

Sometimes it is to protect the base metal from the elements; again it is to form a base for subsequent operations, while no small portion of the deposits from these solutions are for decorative purposes only.

To produce satisfactory results, then, it becomes necessary to vary the chemical construction of the bath by the addition or omission of chemicals that are known to act along certain lines. It would be a very simple matter to manipulate these salts successfully to produce positive results were it not for the fact these same chemicals do not always act in the desired manner. This is due to presence of other salts already dissolved in the solution that may completely destroy that salt which is added to produce the desired color or finish.

That a better understanding may be had, your reader will describe a series of copper and brass solution experiments.

The electrodes were carefully weighed, and connected in series, so that the current which deposited in the first cell then flowed to the next, and so on through all of the baths, of which there were four.

Storage batteries were used, and furnished eight volts. A Millampere meter was included in the circuit, the resistance of which permitted .090 ampere to pass through the meter. The electrodes were 2x2 inches, or eight square inches in the surface of each (both sides); the distance between the electrodes was about five inches; the plates were weighed at intervals of about twenty-four hours and notes taken of the condition of the deposit.

From the following figures we can trace some of the reactions that take place in your plating solutions. Attention is called to the solutions in which sodium bisulphite appears in the formula:

Solution No. 1 was of unknown composition for depositing copper. Free cyanide equaled about $\frac{1}{8}$ ounce per gallon, s. p. gv.

7 deg. Be. The deposit was very copious and of a brilliant red color. Objections: Much of the deposit was non-adherent and of a sandlike nature; the portion that did remain fast was somewhat brittle and cracked when bent.

During the first twenty-four hours the anode lost 1.15 grams, while the cathode gained 1.74 grams. This shows that the solution lost .59 grams of the metal deposited, or 34 per cent. This reaction sets free an equivalent of the cyanide and causes the bath to work in an entirely different manner.

During the next twenty-four hours the anode lost 1.38 grams, while the cathode gained 1.63 grams. This solution lost .25 grams of the metal deposited, or about 16 per cent. This shows very clearly the effect of the content of free cyanide.

We have noted the increase of cyanide during the first day run; now note the difference in the amounts that the anodes lost during the two days. You will find the anode loses most in the presence of the largest quantity of cyanide, while it is also noticeable that the cathode gains more rapidly in the absence of cyanide; that this is so is easily proven by the figures of the third set, which represents the third twenty-four hour run, when the anode lost 1.42 grams, and the cathode gained 1.28 grams. This shows the solution gained in metal .14 grams, which amounts to 10 per cent. Of course, this consumes more of the free cyanide and brings the bath to a condition favorable for the heavy cathode results shown in the final run of thirty-six hours, when the anode lost 1.87 grams, while the cathode gained 2.18 grams. This shows a solution loss of .31 grams or 14 per cent. of the metal deposited not furnished by the anode.

The anode worked fairly clean.

Current dropped from .040 to .030 ampere during the periods, owing to the increased resistance due to the coating of the anodes.

Solution No. 2 is a common solution, composed of:

- 4 oz. Dry Carbonate of Copper.
- 8 oz. Cyanide.
- 1 gal. Water.

Under the same current conditions as No. 1, it gave a very compact deposit, which in no sense could be considered brittle, although the color of the deposit was red, and dead, being without luster. The solution furnishes only 8 per cent. of the metal deposited. By comparing the figures shown in the table for No. 2, we find that the same conditions prevail in regard to the increase and decrease of the cyanide element of the bath.

During the first twenty-four hours the anode lost .84 gram, while the cathode gained only .50 gram, which is a solution gain of 40 per cent.

On the second day this condition was reversed. The anode lost 1.75 grams, while the cathode gained only 2.47 grams, which shows a solution loss of 30 per cent.

Again on the third day the anode lost 1.38 grams, and the cathode gained 1.23 grams, a solution gain of about 10 per cent.

On the fourth day the anode lost 1.74 grams, while the cathode gained 2.06 grams. This shows a solution loss of 15 per cent., or an average for the four days' run of 8 per cent., which indicates that this is the best bath for copper plating where the toughness and thickness of the deposit is of importance. But, where the deposit must be bright, we must resort to the addition of chemicals that will accomplish this end. This procedure changes the character of the deposit as well as the appearance.

In experiment No. 3 you will find the figures on such a solution. It is a brass bath to which has been added 4 ounces of bi-sulphite of soda. We find that while the deposit is bright, it is also very brittle. Of the $5\frac{1}{4}$ grams of metal deposited 17 per cent. was furnished by the solution.

Solution No. 4 was composed of:

- 4 oz. Carbonate of Copper.
- 8 oz. Cyanide.
- 4 oz. Bi-Sulphite of Soda.

In fact, this is some of the same solution shown in No. 2 with the addition of the bi-sulphite of soda. By comparing the figures in experiments No. 2 and No. 4, we find that the bi-sulphite neutralizes the cyanide to such an extent that the anode was not dissolved, and the solution lost 25 per cent. of the metal deposited.

From these figures we learn that the amount of metal deposited from a cyanide solution depends upon the quantity of free cyanide present—as the amount of cyanide increases, the deposit decreases.

The action on the anode is just the reverse. The presence of bi-sulphite of soda necessitates the use of more cyanide and renders the deposit brittle.

	Solution No. 1		Solution No. 2		Solution No. 3		Solution No. 4	
	Anode Loss	Cathode Gain	Anode Loss	Cathode Gain	Anode Loss	Cathode Gain	Anode Loss	Cathode Gain
First day....	1.15 gr.	1.74 gr.	0.84 gr.	0.50 gr.	1.36 gr.	0.28 gr.	1.62 gr.	1.63 gr.
Second day....	1.38 gr.	1.63 gr.	1.75 gr.	2.47 gr.	1.24 gr.	2.17 gr.	1.38 gr.	1.53 gr.
Third day....	1.42 gr.	1.28 gr.	1.38 gr.	1.23 gr.	0.50 gr.	1.02 gr.	0.56 gr.	1.33 gr.
Fourth day..	1.87 gr.	2.18 gr.	1.74 gr.	2.06 gr.	1.21 gr.	1.75 gr.	1.27 gr.	1.95 gr.
Totals....	5.82 gr.	6.83 gr.	5.71 gr.	6.26 gr.	4.31 gr.	5.22 gr.	4.83 gr.	6.44 gr.
Average Solution Loss...	15%		8%		17%		25%	

These figures given are correct only for the solutions described, and cannot be used as a guide, except as they point out in a general way what takes place in actual practice. What has been said about the presence or absence of free cyanide is equally

applicable to the presence of sulphuric acid in a nickel solution. The addition of 2 per cent. of free sulphuric acid to a nickel bath will render it totally unfit for use, for the very good reason that there will be absolutely no deposit of metal from the bath until the current has passed a sufficient length of time to dissolve a quantity of nickel from the anode—that is, the chemical equivalent of the free sulphuric acid—and thus converts the acid to nickel sulphate, or single salts.

There is very little danger of this, however, as there is almost always a quantity of the yellow iron subsalt present in the bottom of the tanks that is soluble in sulphuric acid. This is the *real* reason why a nickel bath *never* tests *acid* with *congo* paper while working with soluble anodes. On the other hand, if aqua ammonia has been added to a nickel solution in excess we find an entirely different action. Here we find that there is little or no action upon the anode, while at the same time there is a copious deposit of metal on the cathode. This deposit is brittle and dark-colored.

Although there is no metal dissolved from the anode while the bath is alkaline, there is metal deposited. What happens? As the nickel contained in a plating solution is combined with sulphuric acid, radical SO_4 is set free when the metal is taken from the solution. This sulphuric acid radical is in turn neutralized by the free aqua ammonia to form ammonium sulphate. Eventually the bath becomes neutral and works well again. It is necessary to add an equivalent quantity of single salts, then to bring the bath back to the original double salt bath. While in the solution that had the acid a like quantity of ammonia sulphate will bring it to a like condition.

Of course, there are other ways to bring about this desired result, but the above is what happens when you work your new solution hard for a long time before it plates satisfactorily.

The plater of yesteryear was a man of main strength and awkwardness, for that was about the only way for him to obtain knowledge relating to his art, which in the main was unwritten.

But methods of that sort will soon be as a bad dream to the plater of to-day, for he is being "Proctorized" by the A. E. S. In place of the old guess-work, there will come (as it has already in some factories) a laboratory equipped with suitable apparatus for making voltmetric tests of all solutions, be they pickeling, nickeling or oxidizing.

Tests will be made daily, if necessary, and you will simply put down six and carry two, and think, "Gee, but this used to be hard to do."

Give an order to the stock-room boy for one pound and forty-five grains of cyanide, or necessary chemical, put that into the solution and *know* that the solution is going to work, not perhaps, but right.

*Read by F. J. Liscomb at the St. Louis Branch, March, 1913.

Electro-Deposition of Brass of Various Colors

By Thomas G. Harper*.

SOME years ago the "Brass World" published a series of papers on the "Electro-Deposition of Brass and Bronze and the Maintenance of their Solutions" in which I was much interested; but while my experience does not agree with all the statements made in the various papers, I was impressed with the value to the practical plater, of some of the suggestions found therein, and particularly with a table setting forth different colors of brass obtained by varying the percentage of copper and zinc in producing a series of castings; noting the color obtained, and analyzing a portion of each, so as to obtain correctly the proportion of copper and zinc in each casting.

The result of these experiments is given in the following table which I will set forth together with a few remarks of the author of the original paper:

"Brass World Table."

Per Cent. Copper	Per Cent. Zinc	Color Obtained	Per Cent. Copper	Per Cent. Zinc	Color Obtained
95	5	Copper Red	50	50	Orange
92	8	Red Bronze	45	55	Light Orange
90	10	Gold Bronze	40	60	Bluish White
88	12	Deep Orange	35	65	White
85	15	Light Orange	30	70	Grey
80	20	Greenish Yellow	25	75	Grey
75	25	Golden Yellow	20	80	Grey
70	30	Full Yellow	15	85	Grey
65	35	Full Yellow	10	90	Grey
60	40	Golden Yellow—Light	5	95	Grey
55	45	Golden Yellow			

In regard to this table the author says, in part: "The color of these alloys is based on observation by the author. A series of alloys were made up according to the proportion given and cast into small bars. An analysis of each bar was made in order to ascertain the exact composition. The color was then noted. If the percentage varied more than one-half of one per cent. a new alloy was made in order to obtain the correct proportions. These colors may be depended on for trustworthiness.

Every color given in the preceding table may be obtained in a brass solution if it is properly made. The brass deposit obtained is an alloy of copper and zinc and by manipulation of solution and electric current, varying proportions of copper and zinc may be deposited, with accompanying variations of color. In a well regulated bath the proportions of copper and zinc should be the same as those in the alloy that is to be deposited. Normal conditions can then be maintained."

Now from a careful consideration of this table and the author's remarks, we are able to see at once what proportion of the metals copper and zinc are necessary in compounding a solution to give a deposit of brass of a desired color; and I may say that in making up experimentally, several solutions according to the percentages given in the table, I have found the claims of the author very fully sustained; the color of deposit obtained in each instance being the same as that in the table.

However, it seemed to me the table did not go far enough as it gives the percentage of copper and zinc necessary to obtain a deposit of brass of a desired color in actual metal; whereas the plater making the solution, will usually have to deal with his metals in the form of some of the various salts.

Now realizing that it is not always convenient for the general plater to figure out the metallic content of the salts he may be using, I have prepared another table corresponding to the preceding one, translating the percentages of the metals copper and zinc into equivalent weights of the sulphates of each metal; and which, if compounded into a solution in a proper manner, will result in obtaining a deposit of brass of any desired color. The table follows:

Per Cent. of Copper	Per Cent. of Zinc	Color	Ounces of Copper	Ounces of Zinc
95	5	Copper Red	4	$\frac{1}{4}$
92	8	Red Bronze	4	$\frac{4}{10}$
90	10	Gold Bronze	4	$\frac{1}{2}$
88	12	Deep Orange	4	$\frac{5}{8}$
85	15	Light Orange	4	$\frac{4}{3}$
80	20	Greenish Yellow	4	$1\frac{1}{8}$
75	25	Golden Yellow	4	$1\frac{5}{8}$
70	30	Full Yellow	4	2
65	35	Full Yellow	4	$2\frac{1}{2}$
60	40	Golden Yellow—Light	4	3
55	45	Golden Yellow	4	$3\frac{2}{3}$
50	50	Orange	4	$4\frac{1}{2}$
45	55	Light Orange	4	$5\frac{2}{3}$
40	60	Bluish White	4	$6\frac{3}{4}$
35	65	White	4	$8\frac{1}{3}$
30	70	Grey	4	$10\frac{1}{2}$

As may be seen by the table, I have taken 4 ozs. of copper sulphate as a constant, and figured the percentage of zinc necessary to make 100% for the whole metallic content per gallon of solution, from that.

To make a solution according to the table, first decide on the color of brass deposit desired, next take the weight of sulphate of both metals and dissolve either separately or together in hot water, and allow to *cool*; next convert the dissolved sulphates into carbonates by the addition of a solution of sodium carbonate, until all metal is precipitated, a slight excess of sodium carbonate

solution will do no harm, allow all to settle a couple of hours and pour off as much of the clear liquid as possible without losing any of the precipitate; refill with clean water and repeat five or six times. Now prepare a solution of C. P. cyanide of potassium or sodium and add slowly with constant stirring until all the carbonates are just dissolved; next dissolve $\frac{1}{2}$ oz. carbonate of ammonia and add with sufficient water to make one gallon. From $\frac{1}{4}$ oz. to 1 oz. of C. P. cyanide per gallon should be added according to the amount of metal in solution to supply free cyanide.

This solution will give first-class results in the deposition of brass of any desired color and will keep bright a long time without any addition whatever, but when after long use it may be necessary, any of the usual brighteners may be used. The following having given good satisfaction with me:

Resulphite Sodium	10 ozs.	} Dissolve in one gal. water.
White Stick Caustic potass..	4 ozs.	
Phosphate Ammonia	2 ozs.	

From time to time as may be necessary a few ozs. are added to the solution and thoroughly stirred in; preferably at the close of the day's work.

Any one of this series of solutions is suitable for any class of work, as they may be made in any degree of concentration. At the strength set down in the table they are usually suitable for a general line of plane surface or flat work; but for work having deep hollows or for the "roller plater," for which a higher degree of concentration is desirable, it is only necessary to multiply either of the formulae by 2-3-4, etc., to get as rich a solution as required, and still keep the relative percentage of copper and zinc in the solution.

In conclusion a few words as to the constitution and management of solutions in general will not be out of order.

I have a theory which I think has been fully borne out in my experience, that of all electroplating solutions, those give the best results which are simplest; that is, those solutions in which the chemical contents are confined to such substances as may be necessary to the proper deposition of the metal in a bright and reguline conditions avoiding all chemicals the addition of which, unnecessary at best, may often lead to vexatious complications. In this regard I consider it to be in accordance with sound principles to add all chemicals carefully, bearing in mind that it is easy to add any ingredient to a solution, but if it proves unsatisfactory it is often extremely difficult to remove or neutralize it, therefore, in my judgment, nothing should be added to a solution without a distinct understanding of the benefit which may be expected to be derived therefrom.

*Read before Rochester Branch.

The Making and Management of a Brass Solution

By H. E. Willmore.*

IN selecting as my subject the brass solution, I recognize the fact that it is one that has been threshed out by writers innumerable; but I have yet to see it treated from the practical brass plater's point of view—by this I mean by the man who is constantly producing large quantities of work from the brass solution every day. Theorists have presented it in text-books, from knowledge gained from laboratory experiments in small quantities of solution, which prove of little value to the man operating a bath of several hundred gallons and producing large quantities of brass-plated goods.

Times and methods change; we are not living in an age when, as formerly, few platers had any knowledge of electro-chemistry. They are fast getting away from guess-work methods, and are using more intelligence in the use of material that goes into the construction of their plating solutions. Experience proves that in order to insure a perfectly smooth and reguline deposit on a metallic surface, a great deal depends on the composition of the solution. Nothing should enter into its make-up unless it serves some definite purpose. The more complex the solution, the greater will be the difficulty in maintaining it in perfect working condition. Contrary to the usual ideas advanced, the brass solution, in my opinion, requires no more care in its management than does any of the other cyanide solutions. It is true that in the brass solution there are two metals to contend with; but if it is properly balanced when first made up, and the plater knows his solution, there is no reason why it should not continue to work successfully.

All writers emphasize, and very properly too, the disadvantages of a too great cyanide content; but, from my own observation, have found that the tendency among platers is in the opposite direction and more frequently the solution does not contain enough cyanide to keep its component metals in proper combination. I do not advocate the use of so much free cyanide that large quantities of gas are evolved at the anode, and no deposition of metal takes place; but there must be cyanide enough so that dissolution of the anode takes place freely. In the disintegration of the anode by the electric current the free cyanide readily takes up the copper and only sparingly the zinc, some of which will remain as an oxide on the surface of the anode. The less free cyanide the solution contains, the greater will be this deposit of zinc oxide; and under the same conditions, part of the zinc will separate from solution and will give it a cloudy appearance.

If the condition of the solution will not admit of a greater free cyanide content, then part of this separated zinc can again

be brought into solution by the addition of ammonia; but only enough should be added at one time to bring up a good yellow brass color. The indiscriminate use of ammonia in brass solutions is the cause of more trouble for the plater than any other addition that can be made to it. In the making of a brass solution cyanide will at all times take up the copper first, and, if there is not a sufficient amount used, when the addition of zinc salt is made, part of the zinc will separate out and the copper will remain in solution. Ammonia is then resorted to to bring up the zinc so that yellow brass is deposited; but the ammonia does not compensate for the insufficient amount of cyanide, because in working such a solution variegated shades are produced on a single article. If the pieces are of a fairly large size, the parts most exposed to the anode will receive a deposit of zinc; next to this the article will show a fairly good brass shade, which will blend through a bronze color to that of copper. As the ammonia gradually evaporates from the solution, a bronze-colored deposit is produced. Under these conditions, the anodes become coated with zinc oxide, so that finally the passage of current is entirely obstructed, and no deposit of metal will occur on the cathode. The bath will then resemble a weak solution of whitewash. The addition of cyanide at this time in quantity large enough to clear up the solution, and enough in excess to conduct the current freely, will put the solution in good working condition, provided the copper and zinc content are rightly proportioned. If too much cyanide is added, it will result in the deposit blistering, which will also be the case with an excess of ammonia.

A certain indication that the solution contains too large a quantity of free cyanide is when the anodes present a bright appearance while the current is passing. The anodes during the working of the solution should have a dark brownish appearance, clearing up when the current is stopped. Another frequent cause of the anodes coating over is an insufficient amount of metal in the solution. All plating solutions offer considerable resistance to the passage of the electric current, and as there is a limit to the amount of cyanide that can be beneficially used, other salts are added to diminish the resistance, these consisting mostly of the carbonates of soda or potash, or their hydrates. Cast anodes are better adapted to the deposition of brass than are those of sheet metal, as they disintegrate more freely. They should contain, preferably, 66 per cent. copper and 34 per cent. zinc.

In most formulas calling for the carbonates of copper and zinc, double the amount of the former is given to that of the latter. This would be correct if the metallic content of each were identical; but as copper carbonate contains 55.22 per cent., or, in other words, 8.83 ounces of metallic copper to the pound, and zinc carbonate 29.05 per cent., or 4.65 ounces of metallic zinc

to the pound, it will be readily seen that a solution composed of two parts copper carbonate and one part zinc carbonate would contain approximately four parts metallic copper and one part metallic zinc; while to produce yellow brass the general practice among founders is to use two parts copper and one part zinc. So in using the carbonates of the metals, the amount of each should be very nearly equal.

While the composition of a brass solution may be perfect in every respect, a proper regulation of the current strength, the amount of anode surface exposed, and their distance from the cathode have considerable influence on the deposition of this alloy. It will be found in working the solution that a variety of shades can be produced from one solution, depending upon its temperature and the strength of the current. The higher the voltage, the greater the excess of zinc deposited; while a current of low intensity tends to deposit copper alone. My own preference is from 2.5 to 3.5 volts, depending on the density of the solution.

In preparing a solution for the deposition of brass, I prefer not to follow any given formula, but to first connect up the tank electrically, hanging the anodes on the positive rods; partly fill the tank with water, and, for each gallon of solution it will finally contain, add one pound of potassium cyanide. Next, I add plastic carbonate of copper until, by testing with a piece of clean metal suspended from the negative or work rod, a good, bright deposit of copper is obtained. It will then contain about the right amount of free cyanide. In another vessel, dissolve in hot water about two pounds of cyanide to the gallon and to this add moist carbonate of zinc as long as the solution remains clear. This should be added gradually to the copper solution until the piece of work suspended therein takes on the characteristic color of brass. Next add, previously dissolved in water, three ounces of caustic potash for each gallon of solution. This increases the conductivity of the solution and tends to prevent the formation of zinc oxide on the anodes. The tank can now be filled with water to within three or four inches of the top.

If a bright deposit of brass is desired, a small amount of arsenic is added. My method of making the addition is to first dissolve one pound of caustic potash or soda in one quart of water and add to this one pound of powdered white arsenic. Stir well until all is dissolved. Take two ounces of this mixture for each one hundred gallons of solution and add eight ounces of liquid ammonia and about ten drops of sulphuric ether. It will be found necessary to frequently add arsenic in this manner if the deposit is to remain bright. Care must be taken, however, to avoid an excess, as should this occur, the deposit will be dull and present a gray appearance. A method of removing arsenic from a brass solution is by the following mixture: Sulphate of magnesium, 4 oz.; sal ammoniac, 4 oz.; aqua ammonia, 3.5 fluid

oz.; water, 1 quart. One oz. of this solution will precipitate magnesium ammonium arsenate equivalent to 1/10 oz. of arsenious oxide, which may be separated from the solution by filtration or decantation. I have found that by the addition of a small amount of aluminium sulphate to the brass bath a color is obtained that very much resembles gold. The amount of aluminium sulphate used should not exceed 2 lbs. to each 100 gallons.

It is well to keep a concentrated brass solution on hand with which to replenish the metallic content of the bath occasionally; for a brass anode never dissolves freely enough to maintain the solution at its normal metallic standard, and unless this is done, the solution will be gradually deprived of its metal. If the amount of metal passed into the solution from the anode was equivalent to that deposited on the cathode, this stock solution would not be necessary.

*Read before Chicago Branch, July 12, 1913.

It has often been said that the members of the A. E. S. do not take full advantage of the opportunities offered by this Society. If for any reason you are out of a position, let your Secretary know immediately as there are almost always a few open. If you are in trouble with any solution or want to know anything regarding plating, write the Editor and he will try and have your problem solved. This is a direct appeal to *you*.

The Electric Current in Electro Plating

By H. J. Richards.*

WHEN I first started plating we had to work with batteries, we worked entirely by results, the voltage and amperage being unknown. The batteries were connected in series of about six cells, and it was one of my earliest jobs to take care of them. We were guided entirely by the looks of the work, no rheostats being used, and we cut in more batteries or took away according to the amount of the work being plated. The results obtained were often surprisingly good and often very bad.

Batteries continued in use long after the first plating dynamos were on the market, being favored especially for gold and silver plating for many years.

The first type of dynamo which was made for plating was the old series wound type. The voltage of this machine being very inconsistent, varying with every change of speed and also with the load, necessitated the use of some means of cutting down the voltage when it became too high. So the tank rheostat came into use, and has ever since remained with us, being made in the first place solely to overcome the faultiness of the dynamo. Of this tank rheostat I shall have more to say later on.

After the series wound machine we got the shunt wound—the voltage of this machine was more constant, but which quit generating altogether when too much overloaded. And now we have in general use the compound wound multipolar dynamo with its voltage controlled by a field rheostat. And in large dynamos we have the same machine, separately excited and with its voltage controlled by a field rheostat which is cut in on the exciting current. This is absolutely the best machine yet made, in my opinion. About the beauties and advantages of this machine I could talk at considerable length, but it is not my intention to give a lecture on dynamos, I wish to show that we have a far better current than we had years ago and therefore it is possible to use it to better advantage.

Now, if you will bear with me, I will say a few words on the B. C. of the electric current and the methods of using it. The voltage, as we all know, is the force or pressure of the current, and the ampere, the volume or quantity of the current. For each and every purpose for which the electric current is used (save only in electro plating) you will find that invariably the current is furnished to the using apparatus at the exact voltage required. The amperage needed is not definitely known, so the wire is made large enough to carry the maximum quantity that can be needed.

The dynamo is made to generate the current constantly and steadily at the voltage required and the amperes as needed and used. If you will stand and watch the instruments on the line

of a dynamo supplying current for some large electric elevators you will see the volt meter steady and constant at the required voltage but the ammeter continually showing large and rapid fluctuations. Showing exactly how the dynamo responds instantly and automatically to the demands made on it generating the current steadily at the desired voltage and the amperes exactly as called for by the motors, lights or other current using appliances, unless, of course, the amperage needed is beyond the maximum capacity of the generator and even then all modern dynamos will take care of a considerable temporary overload.

Now to come to Electro Plating where we need a current of very large amperage at a very low voltage. How much voltage do we need in a nickel solution?—two volts, we are all agreed on that. If the current has more pressure than two volts the work will burn. How much amperage will any tank need. We don't know, we can't give it too much because it will not take more than it needs, if the amperage is not enough then your deposit will suffer. If the wiring at any point is not big enough or good enough conductor to carry the amperage which the tank should have and is demanding, it will *consequently take considerably longer to deposit the thickness of metal required than it would do if conditions were right*. Nor is this all the point in your line which is of insufficient carrying capacity for the needed amperage will become heated owing to the resistance encountered at that point to the flow of the amperage demanded by the tank. The heating of the wire, as is well known, increases the resistance to the passage of the current and decreases its ampere carrying capacity. Therefore, at the time your tanks are demanding more current they are getting less. That is, of course, if your wiring at any part is hot.

In looking at the catalogue of a well-known supply house introducing the tank rheostats, I find the following:

“A suitable rheostat should be selected for each tank, the size depending on the maximum amount of current which it is *likely* the tank will draw from the line under normal conditions.” Now what are normal conditions and what is the maximum amount of current which it is likely the tank will draw? The amount of amperage needed per square foot is put at 4 amperes by some and 6 amperes by others, but a square foot of heavy cast iron will probably take ten times the amperage that a square foot of thin brass or copper would take—hard gray iron castings made from scrap take much more amperage than good soft gray iron castings. The best grade of soft sheet steel takes much less amperage than a hard rough poor grade of steel; unpolished work takes a greater amperage than polished work, and so on, every tank in which the solution is not working well takes more amperes than the solution which is conducting good and working well.

The tank in which the anodes are getting thin and light takes more amperage than the tank which is well equipped with good anodes. I have a table before me showing the ampere carrying capacity of soft copper wire, showing that a $\frac{1}{4}$ inch wire will carry 75 amperes; a $\frac{1}{2}$ inch wire, 250 amperes; a $1\frac{1}{8}$ inch wire, 1,000 amperes and so on.

Now I will ask, what is the size of the wire on the first step of your tank rheostat? It is an iron or German silver wire of somewhere about a No. 8 gauge. Iron or German silver being used because they have considerable resistance to the passage of the current. What amperage will it carry? I haven't a table of the ampere carrying capacity of iron wire but I believe I am correct in saying that a copper wire of a given size has 4 times the ampere carrying capacity of iron wire. The capacity of an No. 8 copper wire is 46 amperes. Now, what is the ampere carrying capacity of that No. 8 iron wire when it is hot?—nobody knows, it depends on the degree of heat, the hotter it is the lower ampere carrying capacity it has.

Now a few more words about the modern dynamo before I conclude my argument, and I am going to show you that the tank rheostat is a waste, a detriment and should be declared obsolete. I think you will all agree with me that in all the equipment of a modern plating shop nothing has been improved on so much as the dynamo. The electrical engineer designs and builds them, but to get the best results out of them is left to the plater. Every modern dynamo is provided with a field rheostat for controlling the voltage, this field rheostat solely controls the voltage and has no effect on the amperage. This is to enable the plater to generate the current at the desired voltage. Now what is the use of generating a current at a tension of 5 or 6 volts and providing large solid copper lead wires of immense ampere carrying capacity, wiring heavily and well from anode and cathode to dynamo, and then inserting at the tank a tank rheostat, cutting down that voltage to two volts at that point, and losing right there the large and necessary ampere carrying capacity which we went to so much expense and trouble to provide. You would not allow buffs to be discarded when only half used or half size pieces of tripoli as lime to be thrown away, yet by controlling your voltage at the tank instead of at the dynamo you are throwing away continually that which is of far greater value, namely, a large percentage of the amperage that is being demanded by the tanks. You will say, what about copper plating, brass plating, the electric clean and barrel plating? I will answer I have done lots of copper and brass plating with the dynamo solely controlled by the field rheostat with the finest results and I am daily operating an electric clean successfully, at 2 volts, using the steam coil as a center anode, hanging it vertically from a copper rod in the center of the tank.

As to barrel plating it is far better to have a separate machine because even 5 or 6 volts is barely sufficient. A small 10-volt dynamo costs very little and will be much more efficient. If you want a thick ductile deposit that will stand heavy buffing, if you want more nickel on your work in less time, if you want to cut out all burning and one of the causes of peeling, produce the current at the dynamo at 2 or $2\frac{1}{4}$ volts see that your connections are all good, cut out your tank rheostat, entirely, (the best connection it ever had is a poor one) and you will be astonished at the results.

*Read before St. Louis Branch, June, 1913.

There has been a theory advanced that a secondary reaction is formed at the anode in a cyanide silver solution and silver peroxide is formed. When one considers that during the electrolysis of water hydrogen is formed at the negative (—) pole and oxygen at the positive (+) pole or anode, this theory seems very plausible. Prescott and Johnson say "Silver peroxide Ag_2O_2) is a black powder formed by treating metallic silver or silver oxide with ozone or peroxide of hydrogen. Oxyacids reduce it, forming a silver salt and evolving oxygen." Ozone is oxygen at the moment of liberation, oxygen being O_2 and ozone O_3 . Is it not probable that oxygen being liberated at the anode forms Ag_2O_2 at the instant of liberation? If there is a large enough amount of free cyanide in the solution the Ag_2O_2 is dissolved instantly and is not noticeable. If there is not enough free cyanide it will not be dissolved and forms on the anode in the form of a black powder. What is the opinion of you chemists, near-chemists and would-be chemists?

Benefits of a Cleaner on Stove Work

ARTHUR O'KEEFE*

THERE are a great many cleaners in use throughout the country and as many different opinions as there are cleaners. I will endeavor to explain the use of a cleaner in connection with stove work. The reason I mentioned stove work is to give you my experience on the class of work that I am plating.

It would be impossible to run without a cleaner in a stove shop for the simple reason that it would require from three to four hundred extra men to prepare it for plating otherwise, and even then it would not be as sure as with the cleaner. In my experience with cleaners I have used both the direct and reverse current and at times have experimented with a double throw switch, but must confess that I have had no better results with the last method. In fact, I have not had as good and so I have adopted the reverse current.

There are several kinds of compounds on the market to-day called cleaners, all of which in my opinion are about the same thing with the exception that some of them do not destroy the color obtained by polishing as readily as others, but the principle ingredient in all of them is potash.

The work is racked up as if it were for plating, the switch thrown in and allowed to run for about five minutes. The work is then taken out, rinsed in water, passed through a sulphuric acid dip, rinsed again in running water and placed into the plating solution. We also have a class of work which is run in the cleaner for about three minutes, brushed with pumice stone and then transferred to the plating solution. This class of work consists of what is called side and front heads and compose the jacket of the stove. They are quite expensive to polish so it is up to the plater to make sure they are perfect in the first operation and thus save the extra expense of polishing. I would estimate that we run close to one ton per day in our cleaner.

It is very often the case with the plater that when he sees he is having a success with his cleaner he undertakes to drive all of his work through the cleaner regardless of the class, and sometimes brought up with a very short turn. Often his superiors see and recognize his success with the cleaners and through their lack of knowledge force him into doing things which prove to be detrimental to the plater and a loss to the firm. If he is not a thorough master of the situation it will not be long before he becomes a wreck upon some rock of destruction. Always bear in mind that the cleaner will not do all the work perfectly.

*President of the Detroit Branch A. E. S.

Solutions in General

By Walter S. Barrows.*

AS our meetings have been called off until September 25th, and the members scattered more or less, with their attention daily diverted toward pleasant hours, basking in the sunshine on some sandy beach or reclining peacefully beneath a haystack on grandad's farm, it is, indeed, a difficult task to get them sufficiently interested in the initial number of the "A. E. S." quarterly to put their gray matter to work on a paper for publication.

The writer, therefore, with an earnest desire to lend a helping hand, will endeavor to put together a few words which may prove helpful to some seeker of information relative to our truly interesting occupation.

As evinced by papers which have heretofore appeared in our publication, there are scarcely two platers who agree on all points, and our experience has been that while a certain mode of procedure may apply in one shop, certain modifications are required to produce the same results in another, through a possible difference in the materials treated and the class of finish expected. For this reason platers should be capable of making amendments instead of clinging to one certain idea, the latter having been the trouble with many otherwise clever men.

Electro plating as an art was originally recognized as the process of coating the baser metals with silver by the galvanic current. It being, theoretically, very simple, the idea met with immediate favor owing to the industrial possibilities of such an operation. To make a successful application of this principal, however, it was found considerable experience and skill were necessary. Britannia metal, iron, zinc and lead were considered especially difficult to silver plate and were given a coating of copper prior to the deposition of silver. Cleanliness has always been deemed very important throughout the treatment.

Practical nickle plating, although one of the more recent accomplishments, is equally as interesting as the depositing of the nobler metals, and since Isaac Adams, of Boston, succeeded in producing a nickle solution from salts, free from either acid or alkaline reaction, the metal as a protective and decorative agent has become very popular and a necessity.

Thick deposits are a rarity at the present time, and are usually regarded as unnecessary, owing to the extreme hardness of the metal and its high resistance to wear. Modern competition, however, is to be blamed for much of the non-endurable nickle plating found upon the various wares. In the deposition of no other metal has the manufacturer disregarded the durability viewpoint as in the case of nickel plating. A heavy deposit is

especially desirable upon iron or steel exposed to the elements or animal respiration, and the cost of such deposits is very little in excess of the cost of a mere film when once the article is prepared, so that there is very little excuse for the tons of inferior nickel plating flooding the market of to-day. The advent of the rapid nickel salt may possibly improve the product; this remains to be seen.

Naturally, if it is desired to obtain a heavy deposit in good condition, the difficulties of the plater increase, unless he regards certain apparently trivial and insignificant details, but when conditions are correct it is equally as easy to deposit an adherent flawless thick covering as a thin one.

Experience in plating parts of machines for open air purposes, such as automobiles, bicycles, skates, etc., has convinced us that their coatings are not satisfactory, except in the case of skate blades. For the other products a thin coating is a poor selling point for the salesman. It cannot be a lasting thing of beauty for the customer nor a producer of joy for the plater, who is usually ashamed to admit it is the product of his labor, six months after a sale.

Nickel solutions, now being composed of double and single salts with various additional agents, such as boracic acid, citric acid, magnesia, ammonium chloride and other ingredients, each having a special purpose for certain lines of work, enables the plater to employ a larger range of idea than was permissible in the early history of the art. While these chemical additions are often fruitful of improved results, we strongly advise the plater to fully investigate the effect which any addition may produce before he employs the chemical in baths upon which he is dependent for his daily output of work. The addition of sodium chloride is a common practice, as is also the addition of ammonium chloride. These agents not only increase the electrical conductivity of the bath, but retard the formation or deposition of hydrogen on the cathode, a result which is frequently of vital importance. Sodium chloride usually causes a turbidness which is quite difficult to remove and for deposits upon iron or steel it is sometimes held responsible for short-lived coating, owing to its tendency to promote corrosion. This, however, is seldom the case where heavy deposits are produced. We believe the double salt is less popular among platers than formerly, and possibly justly so, as the useless, though harmless, accumulation of inert salts impress the studious plater negatively. The double salt also produces less effect upon the anode than the more highly concentrated salts, consequently the solution efficiency is less.

In order to maintain a constant metallic strength the solvent properties of the bath must be high, also, as many readers know, the metallic contents of a double sulphate solution does not exceed 2 ounces per gallon at ordinary temperature, which is not

sufficient to produce a heavy coating in a reasonable length of time.

The formation of the basic salts of nickel are often retarded by the addition of boracic acid and the precipitation of iron, prevented, to a great extent, by the addition of citric acid. These agents serve also to prevent the formation of a green precipitate caused by ammonia in alkaline solutions. We advocate the use of sulphate of nickel when replenishing nickel solutions which are low in metal, as an excess of ammonia is thus avoided; also we believe that the addition of ammonia requires special judgment on the part of the plater.

As stated before, the anode efficiency is increased by acid reactions in the bath, and this is amply proven by the rapid nickel solutions now in use. Very few nickel solutions will show an efficiency of 95 per cent., but the cost of maintenance is equally as great as if such were the case.

We firmly believe that one of the greatest faults of the plater who has difficulty with his nickel baths is his utter unconcern or disregard of the metallic saturation of the solutions. To a great extent this should come from the anode, and yet, with the scanty anode surface employed by many, such is an impossibility. Then an equal distribution of anodes on the three positive rods of a double tank cannot effect an even or uniform deposit upon the cathode, because the distribution of metallic is less between the center row of anodes and the cathode than would be the case if the center row of anodes numbered at least one-third more than the outer row. Narrow anodes make this quite possible; in fact, in actual practice an eight-foot tank will accommodate thirty-five anodes in the center, and with twenty to twenty-five on each of the outer rods the deposits will be more uniform and the metallic strength of the bath more stable and minor troubles less frequent.

The purity of the anodes is frequently taken for granted, especially by those whose deposits are of the fifteen or thirty-minute variety, and whose anodes sometimes remain in use for from three to five years, but when heavier deposits are obtained and anodes are consumed in a few months, the plater is perhaps keener to detect any inferiority which he might otherwise overlook.

Copper and iron he may well regard as impurities of a positive detriment to his deposits. In acid solutions the iron may be deposited with the nickel, while in alkaline solutions the iron separates as a basic oxide of iron, and settles at the bottom of the tank, covering the anodes with a bulky slime, and as the accumulation increases the bath becomes more or less foul with floating particles of the oxide, which is of a very light and bulky nature. These conditions are particularly noticeable when the bath is weak in metal, and the solution may be cleared by a liberal addition of nickel sulphate in the solution. The quality

and quantity of anodes is really of great importance, and we cannot understand why it is necessary to use anodes containing 10 or 12 per cent. iron (for which the employer pays from 45 to 50 cents per pound) when 98 per cent. pure anodes are obtainable. With the voltage used in the ordinary shop the 98 per cent. anode would mean a great economy.

*President Toronto Branch.

It is to be noticed with pleasure that the A. E. S. is growing fast. Two new branches have come within the fold during the past four months. Keep the good work going.

* * *

A man's home is where his heart is. A man's heart is where his work lies.

* * *

Do not forget that there are more QUARTERLY REVIEWS to follow this issue and that articles will be necessary for the publication of same. Write one up and let your president have it. Don't say "I can't." That is not a good A. E. S. spirit. Just say, "I'll try." Give the Editorial Staff the information and they will produce the article.

Resistance and Electrolysis

F. J. LISCOMB*

Members of the Detroit Branch of the American Electro-platers' Society:

It gives me great pleasure to appear before this branch tonight. There are several reasons why this is so; first, because of the opportunity to meet you and grasp you by the hand as a plater and become acquainted with artists, of whom I have heard much, though I have seen but few of you before.

Many years ago I used to dream about how nice it would be if there was an association of platers—and now it is here. And since it is here I feel it is up to me to put a shoulder to the wheel and help push the Association up where it belongs. Although not actively engaged in the plating profession or trade, if you please I believe with Mr. Hawkins that "once a plater, always a plater," and consequently you find me where the platers are most numerous.

A second reason for accepting your kind invitation—if a second be necessary—is that I should like to tell you something of what is going on in some of the other branches of the Association that I have visited very recently. At Indianapolis the members are so enthusiastic that they hold a meeting every week and have made arrangements with a very able chemist to give them instructions every meeting. The St. Louis Branch was organized in December. It was my pleasure to be their temporary chairman on that occasion. At present that branch has in the neighborhood of twenty-four hustling members. In Chicago the membership is constantly growing and has now passed the ninety mark.

A third reason for accepting your summons is because the A. E. S. is getting to be a habit with me. But all of this is by the way. Tonight let us consider "Resistance."

"RESISTANCE."

In this paper no attempt has been made to tell a connected story of the volt ampere and resistance, it being my desire to point out some of the troubles that prevail in the plating room on account of high resistance, and supply a possible remedy. Many of you may have had similar troubles arising from an entirely different source.

There are some who believe that a high voltage dynamo is necessary for ordinary still and mechanical plating. As a matter of fact it is indeed a rare occasion that more than five volts is required if a close watch is kept on the resistance of the equipment.

A good thing to remember is that for volts to overcome resistance we must pay dear.

What is resistance?

A homely answer to the question might be drawn from that long glary streak of ice on the sidewalk over which the kids love to slide. By first taking a running start they slide to the end with very little effort or voltage. Now comes a disgruntled owner of the sidewalk with a bucket of ashes and sprinkles them on the sliding place. Back come the kids after school for more fun, but they meet with what? Cinders you will say. True, for you, but the cinders offer a resistance that retards the slider, if he slides to the end he must use more force. If the cinders, or resistance, is sufficient the kids cease to flow or slide along the ice.

In dirt and small wires we find the cinders of our plating circuit.

In electrical work the pressure is called Potential.

The difference of pressure between any two points is called "difference of potential" and is produced by the dynamo, or other source of electricity.

This force is called Electro Motive Force (the force that moves electricity) and is represented by E.M.F.

There is a P.D. between the poles and is equal to the E.M.F. of the source of the current.

As soon as the machine is used to produce current its E.M.F. is still the same, but the P.D. between its poles is now less, and is that part of the E.M.F. which is used to overcome the resistance of the external circuit, which in a plating room would be the dynamo, line, rheostat, connections, solution, etc.

The Volt is the unit of E.M.F. and is likewise the unit of P.D. and may be defined as that E.M.F. which produces the unit of current (the Ampere) in the unit of resistance (the Ohm). The Ohm—the unit of resistance, is that resistance through which an E.M.F. is spent maintaining a current of one ampere.

By resistance is meant the opposition offered by substances to the passage of electricity. It varies very considerably in different substances.

Copper and silver offer the least resistance. The resistance of a 10% solution of sulphuric acid is about one million times that of silver, while pure water has a resistance of about one and a-half million times that of 10% sulphuric acid.

Professor Ohm in 1827 showed that if between any two points on a conductor the voltage be varied the current varies in the same manner. That is, twice the voltage produces twice the current, or, reducing the voltage likewise reduces the current in the circuit, provided the external resistance remains constant.

The plater makes use of this law every day in the plating room, perhaps without knowing it.

That you may get some idea as to the size of an Ohm of resistance let us do a few little examples in arithmetic.

Five volts will force 5 amperes through one Ohm resistance. As our dynamo has only 5 volts, it is manifest that if we get the rated ampere capacity out of the machine, the total resistance must be less than one Ohm. If we are to use 1000 amperes then the total resistance must not exceed .005 Ohm; this bears the same relation to one Ohm that five pennies does to ten dollars.

Let us see how this works in a large solution.

The higher the ampere at 5 volts the smaller will be this fraction of ohm resistance.

You have a source of current at say 5 volts, a plating tank and a rheostat. A batch of work is placed in the tank; experience has taught you that you get the best results with the rheostat lever placed in a certain position. In the case of a nickel bath the position of the rheostat lever is correct when the voltmeter reads, say $2\frac{1}{2}$ volts. That is, you have varied the resistance of the rheostat until the proper amount of current flows for that particular load.

The resistance of a plating circuit is constantly changing, and by studying the reading of the voltmeter and ammeter you will be able through this change to figure to some extent what is the condition in your plating bath.

For instance, you have a cyanide of copper solution. A load of work is placed therein in the morning, the rheostat is set properly, the voltmeter reads $2\frac{1}{2}$ volts, the ammeter shows 100 amperes flowing. Little change will be noticed during the first batch. If the bath is in good condition each succeeding batch may show the same figures, but if the bath is deficient in cyanide, the ampere reading begins to fall and this may continue until almost no current at all is passing. This is because the anodes have been coating over with a non-conducting film of high resistance. This acts as an insulator and shuts off the current wholly or partially. What this resisting film may amount to in ohms, or units of resistance, can be calculated by Ohm's law, which is, $C. \frac{E}{R}$ — and works about like this:

$$\text{Volts} = 5$$

$$\text{Current} = 100$$

Dividing 5 by 100 we find (.05) five hundredths of one ohm.

At the end of several batches, the rheostat and other elements of the circuit remaining the same, we find that the amperes have fallen from 100 to 25. Again we have 5 volts. This we divide by 25, and we learn that the resistance has been increased to $\frac{2}{10}$ of an ohm, which indicates that the bath needs more cyanide to dissolve the insulating film as it forms.

While the current has been falling the voltage seemingly has been increasing and may finally show at 5. This oftentimes leads the un-informed plater to believe that he requires a machine of higher

voltage, which of course is erroneous. The bath needs correcting, not the dynamo.

There are other ways in which the resistance of the circuit is increased so gradually that it is not noticed. Probably the most common is found in plating rooms where nickel plating is done and where they believe that cleaning nickel anodes is a sin, or at least hard work. Anodes left hanging for several months without cleaning the rods and hooks accumulate dust and salts, which, when dry increase the resistance of the circuit with a consequent decrease of the amperes flowing, and lengthen the time necessary to deposit a coat of metal of the required thickness.

Again this resistance hops up in another very common form that has put many a good dynamo in bad, and that is the belief that any size of wire or rod will do for connecting the generator to the tank.

How many times have you seen a large dynamo of say 100 amperes, connected up with a half-inch copper wire, or maybe brass rod or tube. Of course you cannot put that 100 amperes into the tank down at the far end of the room. Of course the obvious solution of the problem is to speed up the dynamo to a voltage the maker never intended it to run at, with the result that it gets hot and burns out.

The next machine that comes on the job is a ten-volt and you commence all over again.

Many of these problems can be solved by a proper application of Ohm's Law, which is, that the current is equal to the voltage divided by the resistance. Get this resistance fellow backed up into a corner and search him, frisk him, rub him down with sandpaper—or any other way eliminate the rascal. He is expensive to have around, he is always sneaking in when your back is turned.

A tank 8x3x3 feet properly equipped with anodes on each side of the tank would have an active surface of about 40 square feet. A cathode is placed in position in the center of the tank and represents a surface equal to the anode.

A zinc solution fills the tank; a flow of 20 amperes per square foot of cathode surface, or a total of 800 amperes is required. Our rheostat is set to permit this amount of current to pass. With an E.M.F. of 5 volts, the resistance of the system of conductors, which of course included the dynamo, line wire rheostats, anodes, solution and all connections, would be a trifle more than $6/1000$ of an ohm. If Ohm's Law then is true, the dynamo of 5 volts and 1000 amperes capacity must have a resistance of .005 ohms, leaving .001 ohms as the resistance of the anodes and solution. Grant that these are adequate to the task and ignore them in the calculation, except where they must be considered, and say that the resistance of that volume of solution is .001 ohm.

The cathode divides the solution in the middle and must occupy this position. Otherwise, the side of the cathode that has approached the anode will receive a deposit heavier in proportion to the distance traveled toward the anode. Reducing this distance between electrode decreases the resistance and permits a greater flow of current, while on the other side of the cathode the distance between the electrode has increased and reduces the flow of current; therefore the amount of metal deposited on that side of the electrode.

This reduction of resistance is the reason why points or parts of work burn when hanging near the anode.

We have seen that in this bath as arranged there is a resistance of .001 ohm, our voltage is 5. By application of Ohm's Law we discover that this solution has a carrying capacity of 5000 amperes, of course 800 amperes is all we want to use.

Now let us start to fill this tank with racks, each of which contains 10 square feet of surface to plate, and each requiring 200 amperes to yield a proper coat of metal in a given time. It is only natural to suppose that when one rack is hung in the solution, 200 amperes will immediately begin to pass; but upon reading the ammeter we discover that instead of 200 amperes there are 600 amperes, or even more, providing the racks and contact points are sufficient to carry it. You will receive a further surprise when the second rack is immersed, as the ammeter reading will increase only 50 or 75 amperes and still be considerably more than half the amount intended for the full load.

When the last rack is in place the increase in the ampere reading is but 25, making the total 800. From this, then, it might be supposed that the current acting on the several racks was 600 for No. 1, 150 for No. 2, 75 for No. 3 and 25 for No. 4. This is not true, however, as the lines of force have been straightening as the racks were put in place; that is to say, that on account of the low resistance much of the current came from the far end of the tank, a portion coming fully six feet to the first rack.

I am assuming that the rheostat or external resistance has not been changed.

There are other things happening while this is going on. In practice, the lower strata of the solution is becoming dense while the upper strata is impoverished—as a consequence more metal is deposited at the bottom than at the top and furnishes a valid reason why a solution should be frequently stirred when being worked with heavy current.

“ELECTROLYSIS.”

When a current is passed through a solution of a metallic salt, decomposition occurs, with the precipitation of metal. This decom-

position is called Electrolysis. The solution decomposed is called the Electrolyte. Electrolysis is attended by the formation of two primary products called Ions. In electrolysis these ions move in definite directions. Those moving toward the anodes are called anions, while those traveling toward the cathode are known as cations. As soon as they reach the electrodes they become changed.

Ions are said to be the atoms, or groups of atoms. On reaching the electrodes the cations are deposited. In some solutions they do not remain deposited because of the nature of the bath. For example, a cyanide of copper solution apparently will not deposit copper because of the large amount of free cyanide present. As a matter of fact the metal is deposited, but the small particles are immediately redissolved. An apparent paradox is found in a copper solution that contains so much cyanide that it will not deposit metal at ordinary temperature, but on heating the bath to 150 to 200 degrees a fine deposit is obtained.

Anodes are soluble or insoluble, while again they may be only partially soluble; an anode to give the best results should be freely soluble. It would then replace the metal withdrawn from the solution at the cathode. But in practice it is seldom that we find such an anode. For instance, if a nickel anode is hard, it does not dissolve freely, with the result that we must resort to the use of carbonate of nickel or aqua ammonia to neutralize the sulphuric acid set free at the cathode. In a zinc solution the anode is soluble in this acid and corrects itself.

Again, when an anode is only partly soluble oxygen gas is evolved. This to some extent clings to the anode and aids in setting up a current in opposition to the main current and is called a counter E.M.F., as it counteracts a part of the direct E.M.F.; it can be classed as resistance. This oxygen gas is very noticeable when rolled nickel is used as an anode.

This counter E.M.F. must be taken into consideration when calculating the amount of metal deposited in a given time on a given surface by the electro-chemical equivalents. This counter E.M.F. being due to adhering gases, soon passes off when the gas rises and leaves the electrodes.

In a storage battery this counter E.M.F. amounts to more than two volts.

A good voltmeter will show the value of the counter E.M.F. when the rheostat has been opened, while the work is still in the bath.

There are times when insoluble anodes are desirable. A case in point is in electric cleaning.

A few words on electric cleaning may not be amiss at this time, although in a previous paper presented at Chicago Branch this subject was treated at some length and is a matter of record in the

REVIEW. Of late years many electric cleaning compounds have been placed on the market and are being pushed very hard; some have merit, others yield much profit and keep the trouble man busy undoing bad jobs.

As to which is the proper direction to run the current it may be said that there is no proper direction, as one line of work seems to require the reverse current while in another line the direct current gives the best results. One electric cleaner company recommends the reverse currents, but in a try-out it was found that ordinary finger marks could not be removed. By changing the directions of the current to direct the marks disappeared. While ordinary iron castings were corroded by the reverse, they were not attacked by the direct.

As to what and which is the best electric cleaner suffice to say that the alkali solution that offers the least resistance to the electric current and permits the maximum amount of current to pass with the minimum voltage of E.M.F. is sure to give the most economical results. In electric cleaning the whole process depends upon the mechanical action of the gases, hydrogen and oxygen, on the surface to be cleaned, and not upon the alkali which does not saponify the mineral oil or greases used in the manufacture of the articles to be cleaned. Since less than two volts is necessary to decompose water and generate these gases it is manifest that more than this amount is superfluous. From this you can see that if the electric cleaning compound requires 10 volts to make it perform that function, it is high time that it is discarded and another installed that will work at less. The most common error is made, however, in equipping the outfit with a small wire.

These are a few of the difficulties encountered in a plating room. As shown, many can be overcome by reducing the resistance.

*Read before the Detroit Branch, March 22nd, 1913, by F. J. Liscomb, Associate Member of Chicago Branch.

He that knows not and knows not that he knows not, he is a fool—shun him.
He that knows not and knows that he knows not, he is simple—teach him.
He that knows and knows not that he knows, he is asleep—rouse him.
But he that knows and knows that he knows, he is wise—follow him.

—*Persian Saying.*

Cold Galvanizing

EARL ECKEMODE*

HAVING had considerable experience in electro-galvanizing on cast iron, malleable iron and hot rolled steel stampings, with very good results, I will endeavor to relate in a general way my methods of success and hope that it will reach some one who may derive some benefit from the same.

One of the most important things to be considered is in the cleaning of the articles to be plated. Having a daily output of many hundred pounds I found it almost impossible to keep help satisfied owing to the amount of nitric acid we were using: it was up to me to find other means of cleaning.

On cast and malleable iron castings I remove scale and sand by sand blasting in a horizontal tumbling barrel. In this way we obtained a much cleaner surface than with the acid dip or even with the scratch brush.

My steel stampings are placed in a water tumbling barrel to which is added about five pounds of No. 60 emery, and tumbled for about one half-hour or longer if necessary. They are then run through an electric cleaner to which is added just enough carbonate of copper to produce a light copper film, thus insuring a perfectly clean surface before entering the galvanizing bath. The emery can be saved by means of a catch basin placed below the opening of the tumbling barrel and used several times. To insure durability, it is necessary to deposit zinc equal to one-half ounce per square foot of surface exposed to the action of the electric current.

For castings I use a solution composed of the following:

Zinc sulphate.....	1½ pounds
Sal ammoniac	3 ounces
Sulphuric acid.....	4 ounces
Water	1 gallon

As in my case it frequently happens that the manufacturers desire to bend sheet steel after galvanizing, this requires a very ductile adhesive coating. For this kind of work I run a solution as follows:

Zinc sulphate.....	2 pounds
Sal ammoniac	2 ounces
Sulphuric acid.....	1 ounce
Water	1 gallon

Owing to the small quantity of sulphuric acid used in this solution, I prefer to remove the anodes once a day and take off the scale which adheres very closely.

For tumbling barrel work such as lock parts, screws, bolts, etc., I use a solution of the following:

Zinc sulphate.....	2½ pounds
Sal ammoniac.....	6 ounces
Sulphuric acid.....	4 ounces
Water	1 gallon

I have used the above solutions and methods for many months and have never encountered but very few minor troubles. All tanks are connected to a five volt generator.

*Read before Chicago Branch, July 12th, 1913.

Why?

J. C. DAVENPORT*

HAVE heard the remark "Why, the A. E. S. is a supply house organization." Am willing to concede that nearly all the supply houses are represented. And why shouldn't they be? Who has done a fractional part as much for the platers all over the country as these same supply house men? Who is it now that is boosting this organization in new territory? Did you write them for information as to a job or a solution but what they were right on the job? Did you ever have any of them tell you a cheaper or better way to do what you were doing?

The writer is free to confess that if it had not been for these supply house men as Liscomb, Hansjosten, Chase, L. Hommedieu, Sliter, Gaylord and many others, the writer would probably never have been the successful plater that he is, at least financially. In the past when I got up against it I would go to a brother plater. He would put on a superior air and expialn. He did not know what he was explaining but he would explain just the same. Then I'd go back and put in a little of this or a little of that, look wise and bluff it out until a supply house man would come along. He wouldn't take me in a dark corner and say "Hist!" but would tell me the great secret mystery. "Why just add a little cyanide" or something equally as simple, and my troubles were ended.

Now, since the A. E. S. has come into existence we have come off our high horse, we are getting together, we have heart to heart talks, and find out that none of us knew as much as we tried to make even ourselves believe. Now we have a better understanding not only of ourselves but of our fellow platers.

As to the supply house men, the Indianapolis Branch will always welcome them with open arms and a cozy chair right up in the front.

*President of Indianapolis Branch A. E. S.

Fire Gilding

JOHN E. HARTNET*

ALTHOUGH ancient, this process is in use in a number of places at the present time, but, like everything else, it has advanced, until now the gilder, instead of completing a few dozen pieces of work a day, counts his results in gross lots. In some branches of the trade this process could hardly be dispensed with, as, for instance, where small pieces of work are to be gilded in large quantities and it is necessary to have a good deposit. As the cost of piercing, wiring and the time it would require to plate them in the regular plating bath would be too great in proportion to the small amount it would be possible to turn out, fire gilding is the preferred method.

Fire gilding, as the name implies, is accomplished with the aid of a furnace built especially for this purpose. The latter should have a cast iron cylinder set about 18 inches above the fire, running from the front to the back of the furnace, which is about $3\frac{1}{2}$ ft. long. Connected to the rear end of the cylinder is an 8-inch pipe which runs to a larger stack, which, in turn, ascends through the roof. This stack should rise at least 20 feet above the roof. If the gilding is done in a low building the stack should rise above the surrounding buildings, even though some of them are of greater height, as the fumes from the mercury are very injurious.

The first operation necessary is to make the amalgam, which is done in the following manner:

Fine gold is generally used, cut up in small pieces, and put into a receptacle that will stand the heat; a plumbers' ladle will answer very well for this purpose. To this gold is added the quicksilver, which is then put in the fire. This should be done when there is a good draft, in order that the mercury fumes will not be inhaled. It should be kept stirred gently with an iron rod, bent in the shape of a poker. When the gold is dissolved it should be removed and poured into a dish that has been two-thirds filled with clear cold water, and should then be washed clean. It now resembles a thick white paste which is put in a chamois skin and any excess of mercury squeezed out.

In the gilding room there should be two stoneware jars set up in the same manner as tumbling barrels, at an angle of about 45° . These I will call Barrel No. 1 and Barrel No. 2.

The gilder now takes a batch of work, and after potashing and dipping it clean and free from grease, puts it in barrel No. 1 and adds some clean hot water. He now puts in a small portion of Quick Water or Blue Dip, as it is called. This blue dip is made up in the following manner: Put two fluid ounces of quicksilver in six quarts of nitric acid and let stand until mercury is all taken up.

Two ounces of this fluid added to fourteen ounces of water will give the work a slight film of mercury. Now add the amalgam which has been ground up in a mortar with enough quicksilver to cover the work, that is, enough quicksilver to spread over the work while it is rolling; one ounce of quicksilver will cover four or five gross of small work. Let the work roll for about ten minutes and wash off thoroughly.

The work is now put into a cage (about 8 inches in diameter by 12 inches long) having a rod run through the center, and extending out about three feet at one end. This end is bent in the shape of a crank so that the operator can keep the cage turning while it is in the fire. The cage should be perforated so as to allow the mercury to pass from the work and on through the stack.

When the mercury has been burned off, the gold remains on the work, which is now taken out and allowed to cool. The work now has a very dark brown color. When cool the work is put in barrel No. 2 and hot water added. One ounce of sulphuric acid is now poured in, this acting as a pickel to take off the smut left from the first operation. This is then washed off thoroughly and quick-water added until work becomes clear and white, when it is washed off with clean cold water and again put in the fire. As the work gradually gets hot the mercury passes off leaving a nice gold color.

The reason the writer uses two barrels is this: After barrel No. 1 has been used any length of time it begins to crack and chip on the inside, and the mercury from the first operation gets into the cavity and comes out on the work during the second operation. This must be avoided, as the work does not get enough heat on the second operation to take it off. A separate pot for each of the two operations is therefor necessary.

The writer has been using this process for gilding every day, obtaining good results both in regard to quantity and quality.

*Member of Newark Branch.

It is our intention to publish the pictures of the officers of the different branches in the later issues of the QUARTERLY REVIEW. Any branch desiring the pictures of their officers and willing to stand the expense of having cuts made, kindly communicate with the officers.

Some Thoughts

DR. ABRAHAM TESSLER*

ALTHOUGH there have been hundreds of articles and treatises written on the subject of the chemistry of electro-plating, it is a pity how few is the number of practical guides in the hands of the plater. Too much has been said and too little has been done, for the reason that in many cases there really is a lack of knowledge of the first principles of chemistry as well as the rudiments of electro-chemistry.

It would be rank injustice to lay everything to the plater, for he is not the only one to blame for these unsatisfactory conditions. In many cases, he starts in the shop as a small boy, who works hard for long hours, until he reaches the position of assistant foreman. In this station he also labors hard and long until he becomes foreman plater. Many platers have put in the best half of life working into the night, with no opportunities for reading a magazine—no time to educate themselves; and very often they have eagerly desired knowledge and special training along the line of their profession. So it happens that all the plater knows is the instruction he has received from his foreman and the information he received from dealers and other similar sources.

We must acknowledge the very sad fact that the relations between the plater and the chemist are far from ideal, and the absence of proper co-operation in many instances keeps the plater down to the helpless level upon which he stood years ago. When he has trouble with his solutions—if they spoil or work improperly, he cannot tell whether he is at fault or whether the material used was defective, and often he has to throw away his solutions because of his inability to remedy them; and this—the casting away of material that has done no work, of course increases expenses. If a chemist is called in he has to go the long way around in searching for the seat of the trouble, owing to the simple reason that he has not been sufficiently informed as to how solutions act. On the other hand, practically everywhere there exists gross carelessness among platers in the proper use of electrical instruments—the voltmeter and the ammeter—as well as in keeping the plating rooms in the best condition.

This does not mean that the plater should be a college graduate, or necessarily an expert chemist or electrician; but he ought to get enough laboratory training to equip himself with a comprehensive knowledge of the elementary chemistry of his special field, in order that he may have a clear idea of the chemical processes of his baths and of the electrical phenomena which take place in his tanks. He should familiarize himself with all of the special electro-chemical

terms and their meanings; he should know the formula of all the substances used in electro-plating—for otherwise he cannot have a clear understanding of the reactions and the equations. The sum and substance of the matter is that he simply must not be a mere mixer of stuff and all kinds of advertised salts, cleaners, etc.

Every plater should possess, at the expense of his employer, a copy of George Langbehn's "Complete Treatise on the Electro Deposition of Metals," and he should have facilities to conduct his own experimental research and should hold it his duty to closely follow up all inventions, improvements and discoveries along the line of plating.

The plater should not consider the chemist a man from "the office," but a professional friend and help. The chemist who joins the Electro-platers' Society should not keep quiet all the time, but must bear in mind that he should be of some use to its members and should endeavor to read papers and give lectures directly connected with electro-plating. "In union there is strength," and the motto of this Society should be—a constant exchange of opinions and ideas and results, in laboratory and in shop—in short, "an intellectual get-together." The open meeting should be the moral and intellectual band between all the members of the Newark Branch, and also between this branch and other branches.

*Member of Newark Branch.

To the Members of the A. E. S.:

It is my aim to get familiar with the life of the platers in the different states, with the conditions of work, average earnings and a history of the plating plant, etc. It is also very important to establish facts as to how each plant began and has grown or fell, and the reasons thereof.

For instance, some one may have started a nickel or copper plating plant and it was either a success or a failure. What are the reasons? How do the manufacturers treat and appreciate the plater? What is the social standing of the plater in his community?

This information is necessary for the article which is to be published in the December QUARTERLY REVIEW. I think all the platers will try their best to help me out in this work. This will be of great benefit to everybody concerned and will be the first step in our statistics. No names will be mentioned in these statistics unless desired.

I hope all the members of the A. E. S. will furnish me with these facts and figures as they are necessary in all statistical reports.

DR. ABRAHAM TESSLER,
282 Fourteenth Avenue,
Newark, N. J.

Determination of Gold and Silver in Cyanide Solution

CHARLES FISKE, JR.

FOR GOLD—

Measure out accurately, with a pipette attached to a long rubber tube to prevent its being sucked into the mouth, 5 cc of the solution.

Add 10 cc concentrated C. P. Sulphuric Acid (H_2SO_4)—carefully to avoid spattering, then two grains of Oxalic Acid, evaporate until dense fumes of Sulphur Dioxide (SO_2) are evolved. Cool, add 200 cc distilled H_2O and one gram $H_2C_2O_4$ boil. Filter on porcelain Gooch crucible or filter paper, wash three times with boiling H_2O , then three times with NH_4OH water S. G. 26, to remove any trace of Copper Oxalate or Silver, which may have precipitated with the gold; then wash thoroughly with boiling H_2O , until washings give no test for NH_4OH —ignite and weigh gold.

CALCULATION.

5 cc amount taken—

grams precipitate

$$1 \text{ cc} = \frac{\text{grams precipitate}}{5 \text{ cc}} = \text{amount 1 cc}$$

$$1 \text{ gallon} = 3,785.37 \text{ cc} \times \text{amount 1 cc} = \text{grams per gallon}$$

$$\times .6430 = \text{Dwts. per gallon.}$$

Factor

NOTE.—In cases where solutions are very weak, *i. e.*, less than six dwts. of gold to the gallon, or .6 of an ounce of silver to the gallon, a larger sample should be used—10 cc, or even 20 cc may be necessary, this left to the discretion of the assayer.

FOR SILVER—

Measure out 5 cc solution into 400 cc beaker, add 10 cc concentrated C. P. Hydrochloric Acid, boil until white precipitates of silver chloride settles out, add 200 cc distilled H_2O , boil to coagulate precipitate. Let stand about two hours or until thoroughly cold; filter on porcelain Gooch crucible or tared filter paper. Dry at $100^\circ F$. in air bath to constant weight (about one hour).

CALCULATION.

5 cc amount taken

Result = grams Silver Chloride

.75275 Factor to convert Silver Chloride to Silver
grams precipitate $\times .03215 =$ ounces in 1 cc

5 cc

$$3,785.37 \text{ cc} = 1 \text{ gal} \times \text{ounces in 1 cc} = \text{ounces per gal.}$$

*Associate Member of Newark Branch.

American Electro-platers' Society

(An Educational Society)



Chartered 1909

QUARTERLY REVIEW

DECEMBER-JANUARY-FEBRUARY

1913-1914

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QUARTERLY REVIEW

American Electro-platers' Society

(An Educational Society)

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No. 3

Editorial

THE NEXT CONVENTION

MORE than a year has swiftly passed since the first convention of our Society, and the date of the second convention is drawing near. So near in fact that the convention should be a live topic at every meeting, and it is perhaps unnecessary to remind the members that it will be a very important event in the history of the Society.

Chicago Branch is awaiting in pleasant anticipation the visit of the representatives of its sister Branches, and is preparing to duplicate the royal welcome and beautiful hospitality that the Mother Branch extended to the delegates to New York last year.

It is time for the Branches to elect their delegates and to instruct them as to their wishes in any of the matters that the Branches are interested in having brought before the convention. There will no doubt be some suggestions for changes in our present laws, and many new ideas for new laws will be advanced. More delegates will be present than were at the last convention, and more opinions will be expressed, and as our present laws have been tried for a year or more, we now know how suitable they are for our needs and if any weak points have been noticed, the experience of the past year will tell us how to strengthen them.

The importance of being represented by one or more delegates can not be too strongly impressed on the Branch Societies. It is the only chance that the membership has to meet and discuss the many things that come up in the course of a year in a society that has grown as rapidly as ours has. To give the Society a good start for another year of prosperity and progress will be one of the chief

duties of the convention, and this alone should be incentive enough for every member in every Branch to boost the convention and insist that his Branch be represented and represented strong.

It is time now that the Branches that may have new laws to suggest, or amendments to existing laws to offer, to get busy on their ideas and put them in such shape that they may go before the convention in proper form. And send them along with a delegate who can put up a good argument, for there is nothing that will stir up interest like a good argument, and interest at meetings and conventions means interest in our Society, and interest in our Society means progress.

There is little use to point out the benefits that we have enjoyed because of our membership. If the Society had done nothing else, it has added dignity to our profession, and brought to the attention of the employer the plater and the plater's problems, and those two things alone are worth every effort made and every penny spent to promote the Society. It has not only made us better platers, but also better men, for it has made us friends, with a friendly feeling for each other, and who can say that any movement that promotes friendship does not add to the sum total of human happiness, and anything that promotes happiness makes men better.

So, brother plater, get busy and see to it that your branch is represented in the convention. Boost and then boost some more. Your officers are doing their best, and, being your servants, will go as far as you want them to. So send your delegates to the convention to tell what you want your officers to do for another year. And come yourself. You'll enjoy it and profit by it, and until we all meet in Chicago BOOST THE CONVENTION.

J. H. H.

St. Louis Banquet, January 24th, 1914

ST. LOUIS branch, A. E. S., held their first banquet at the American Annex on Saturday, January 24th.

Eighty-one (81) members and their employers were present; it being one of the objects to enlighten the manufacturers on the real work and show them (as we are from Missouri) that the benefits received are mutual.

The hustling ability of E. J. Musick, chairman of committee, was shown by the attendance, and after an excellent dinner served in the magnificent banquet room of this new hotel, he introduced H. H. Williams, secretary and treasurer of St. Louis branch, as toastmaster. Mr. Williams in a few words extended a welcome to all and stated a few facts concerning St. Louis branch, as follows: That on December 5th, 1912, it started with nine members and a month later with nineteen members applied for a charter, and at present has twenty-six members in good standing. He also told of the work it was doing and the results.

Mr. E. Lamoureux, of Chicago branch, was introduced as the father of the branch, he having been instrumental in starting it off. Mr. Lamoureux read a paper on "Efficiency: Technical and Business Ideas on Electro-Plating."

"The Past, Present and Future of Electro-Plating" was the subject of a paper read by H. J. Richards, of St. Louis branch. Mr. Richards had a good story to illustrate every point.

"The American Electro-Platers' Society" was the subject of an address by our Supreme Vice-President, J. H. Hansjosten, of Kokomo, and special mention was made of this excellent and able address.

Mr. F. J. Liscomb, of Chicago, read a paper on "Nickel Solution Investigations," which was the result of experiments as to metallic content and other conditions.

One of the pleasant surprises on this occasion was to have present with us the founder of the society, Mr. C. H. Proctor (who also represented our Supreme President, Mr. George Hogaboom). In his address Mr. Proctor congratulated our branch; told of the societies' activities and predicted a bright future for all.

Mr. Oscar E. Servis, secretary and treasurer of Chicago branch, brought greetings from his branch and made an address on "Mysteries of the Past and Co-operation of the Present."

Impromptu remarks were made by the following manufacturers: Mr. C. Phillips, of Landay Stove and Range Company; Mr. F. R. Henry, Majestic Manufacturing Company; Mr. W. F. Koken, Koken Barber Supply Company; Mr. G. Hammon, of Quick Meal Stove Company; Mr. H. C. Hoener, of Bridge & Beach Manufacturing Company; Mr. W. H. Musick, Musick's Plating Works;

also by H. H. Van Horn, H. C. Starrett, of Chicago, and O. Halmbacher, of Decatur, Ill.

Congratulations on the success of the affair were many, and a brighter future predicted for our work.

The following committee was in charge: E. J. Musick, J. T. McCarthy, H. J. Richards, R. O. Bosch and H. H. Williams.

Address by Mr. Chas. H. Proctor

Mr. President, Members and Guests of the St. Louis Branch of the American Electro-Platers' Society:

I can assure you that I feel extremely grateful to have the pleasure of being one of your guests on this auspicious occasion, the first annual banquet of the St. Louis branch. As I have traveled across a portion of the United States to the extreme outpost of our society in St. Louis, the thought comes to me that perhaps in another year or so I may have the opportunity of being present at a banquet in far-away San Francisco, and then our society will extend from the Atlantic to the Pacific Ocean as well as Canada on the north, even as to-day our membership extends across the broad expanse of our mighty land between these great oceans.

To you gentlemen who have labored so incessantly to create the St. Louis branch for the benefit of the craft in your city and near vicinity and for the culmination of your successful efforts to make this evening a milestone in your future development, I extend to you my personal thanks as the founder of the American Electro-Platers' Society. I also extend to you on behalf of the Supreme President, Mr. George B. Hogaboom, whom I have the honor to personally represent, his felicitations for your continued progress and prosperity with hopes for the future that the work you have started out to accomplish may bear fruit beyond fondest dreams.

Looking backwards through memory, that mental diary of the human race, I can scarcely realize that a third of a century has elapsed since I was last in your beautiful city. Many changes must have taken place since that time; modern development must have progressed here as in other mighty cities of our country, and to realize that you, as members of the American Electro-Platers' Society in becoming its votaries, have become a part of that modern development in unity of purpose. Not only for the welfare of the interests of the electro deposition of metals in your city, but in that modern development of our commercial welfare that must constantly be maintained to keep our country in the foremost ranks of the great commercial nations and to maintain American labor upon the highest pinnacle among the workingmen of the world.

In those years of long ago when in your city as a boy, I was a wanderer without a friend and with very little finances in my pocket, "a stranger in a strange land," and as I remember I stood

upon the bridge that spans the mighty Mississippi and dreamed of the future. I looked towards the golden west with its beautiful setting sun, and as I looked again down the river no thought came to me that my next visit would be after the lapse of so many years and then to come among friends and to realize that wherever my footsteps might wander throughout this great country, wherever there was a plating tank in operation I could find a friend.

The American Electro-Platers' Society has made a wonderful advancement in the few years of its history. To realize that it consists, besides the Supreme Society, of thirteen branch societies in most of the largest commercial cities of this country is almost beyond comprehension. No society of a like nature has ever accomplished so much in so short a period, and its progress in the future will, I am sure, be maintained by the continued interest of its members that is constantly displayed by the application of its precepts that are carried out in practice.

To say that you are a member of the American Electro-Platers' Society gives a dignity to your profession which I am sure in the years past was sadly neglected. You know the old saying is that "dignity adds to dignity," so the future welfare of the American Electro-Platers' Society depends upon what you can add to it as members or in the words of the immortal Longfellow:

"Be up and doing, with a heart for any fate,

Still achieving, still pursuing, learn to labor and to wait."

In your regular meetings get up and say something, start some sort of discussion, tell of your little troubles and your pet schemes, and tell it in your own way. There is nothing so interesting as discussions to benefit the plater. Those latent powers that you possess through years of persistency in your profession will come to the surface and you will then realize that you can make a name for yourselves that will not only be a benefit to your branch, but also to the membership at large.

I wish to add my personal felicitations for your future welfare and trust that you will work unceasingly so that the St. Louis branch may become one of the banner branches of the society.

All true work is sacred; in all true work, were it but true hand labor, there is something of divineness.—*Carlyle*.

Efficiency, Technical and Business Ideas on Electro-plating

E. LAMOUREUX,

Member Chicago Branch's Board of Managers, with Manning
Loeb & Co.

IN responding to the request to read a paper at this meeting, I have taken into consideration the fact that it is really very difficult to write upon any phase of our craft and submit anything absolutely new, and while the title of this paper indicates a good deal, I trust your expectations are not too high, because I do not expect to do else but touch briefly on certain points which may be of benefit to us all.

Speaking from the business side of our society, I have wondered whether or not platers realize fully the advantages to be derived from membership, and also whether or not you, Mr. Employer, fully appreciate these advantages. Taking the active and associate membership, as well as the employer of platers, as we are assembled here, it would not require much thought to recall the experiences of well-meaning and ambitious platers, who were more or less lacking in the required knowledge and general ability to manage a department in the proper manner. With the advent of this society, the exchange of knowledge began, and with the establishment of bureaus of information, the standard and efficiency of the membership has been enhanced to a point where its value would be difficult to estimate. This, as well as the fact that the society also maintains an employment bureau, are reasons why every employer of platers should be a staunch supporter of the society. With the advantages gained from the increased standard, and the society working towards standard methods, we have a condition where a change of platers' foreman will not necessarily mean the dismantling of the plant to suit the ideas of the new foreman, and where it will eventually be possible for the new foreman to step into the place of his predecessor, and have everything move on as though no change had taken place. The society has already done more towards bringing the plater foreman and his employer together than all previous efforts. While this has been going on the associate members have assisted toward the success of the movement, and, while there has been comment and criticism on the part of some that the active and associate membership were getting too close together, I want to go on record in stating that nothing, to my knowledge, was ever so far removed from the facts. The plater foreman to-day is further removed from these influences than ever before, and there never was a time in this field when both he and his employer have been more independent. If we will take advantage of the means at hand, the concerted efforts of all three can maintain conditions that will hold the unscrupulous from our ranks, and result in efficiency for all, where a condition of chaos formerly held sway to a large extent.

In reference to the words, "efficiency" and "technical," these words cover a wide field, and it is not my intention to enter into a lengthy discourse upon either. I desire only to touch upon the technical and efficiency side of a particular branch, i. e., Nickel Plating.

We have read much in recent months regarding high-grade nickel salts under various captions and names, and we may grant that all of them have merit from a working standpoint, but absolutely no merit from a price standpoint, because the results claimed can be produced by ordinary methods as will be shown.

In the last two years many plants doing nickel plating have been gradually turning to the use of the single-salt solution, gradually abandoning the double-salt solution. This single-salt solution consists of 24 oz. single nickel salts, 5 oz. boracic acid and $1\frac{1}{2}$ oz. sodium chloride, and will stand at about 13 degrees Beaume. While this solution will give excellent results with 90/92% anodes, it has been found that much better results can be obtained by using anodes of 95/97% purity. The advantage can be noted at once, both from an efficiency and buying standpoint.

In a recent paper read before a branch of this society the statement was made that deposits from double-salt solutions have been found which analyzed as high as 15% iron. This would be due both to the fact that a 90/92% anode contains about 6% iron, and that the solution will take up iron from the work providing pieces which had dropped to the bottom of the tank have been allowed to remain there. While the single-salt solution would take up iron also from parts allowed to remain in it, we have much less than 5% iron to start with.

One of the theories advanced against this solution is that the deposits have a tendency to be of a warty character. A study of actual practice on several kinds of work, composed of brass, steel and iron does not show any such results, unless the deposit is carried beyond the ordinary thickness. I refer here to actual practice where a large volume of work has been turned out constantly every day for two years.

There is a difference of opinion as to the method of operating this solution, and I may state here that the study referred to above has been of solutions made up exactly according to the formula herein submitted, but some parties claim better results by having the solution about four-tenths alkaline to sulphuric acid. This is done by using enough carbonate of nickel to take up the free sulphuric acid; the carbonate should be added until red Congo paper no longer shows any discoloration; this has been found to give a condition near enough to four-tenths alkaline for all practical purposes, and at this point there is no free sulphuric acid, but the boracic acid is free to act. The following important points about this solution may be considered: To date no case of pitting has ever been brought to my attention, and if used with the high-grade anodes there is practically no sediment, resulting in a much cleaner tank

condition, and even at 13 degrees Beaume there is practically no crystallization around the anodes or sides of the tanks. If we take nitric acid of 1.18 specific gravity and put a drop of this acid at the weakest point of a 19-minute deposit with a current density of 9 amperes per square foot, it will withstand the action of this acid 6 minutes, whereas it has been found that the same objects plated in the regular standard double-salts solution with a current density of $4\frac{1}{2}$ amperes per square foot, a deposit of two hours' duration would not withstand the action of this same acid more than three minutes. Another specific instance, on the efficiency of output per day, may be stated by taking an every-day workshop condition and following up results on 20 square feet of surface to be plated. In this particular plant all tanks are connected with separate ammeter shunts with proper lead wires, through conduits, to a switchboard, upon which is an ammeter of three hundred ampere capacity. By turning a switch to any tank by number we get the separate reading of the amperes flowing in that particular tank which permits of positive as well as very accurate results. The usual amperes per square foot for nickel, as you know, is four, and taking 75 ampere at $2\frac{3}{4}$ volts pressure in a double-salts solution standing $7\frac{1}{2}$ degrees Beaume, and a single-salts solution at 13 degrees Beaume, it was found that each batch of work in the single-salts solution tank could be taken out in 35 minutes, whereas that in the double-salts solution tank could not be taken out in less than one hour, and stand the buffing and wear to which this particular work must be subjected. By raising the amperes to 110, or an average of about 5.5 amperes per square foot, and $3\frac{1}{2}$ volts pressure, we could increase the output of the single-salts tank or the density of the deposit, whereas the work in the double-salts solution tank would burn to a point where it was very difficult to buff. Analysis of the deposit shows that of the single-salts solution with 95/97% anodes to contain .27 of 1% iron, while the deposit from the double-salts solution with 90/92% anodes showed 4.74% iron.

While the initial cost of this method of plating is higher than the other, all the users claim a lower maintenance cost per year, as well as a saving in buffs; in some cases as high as 50% and a consequent saving also in composition.

We all know that mechanical plating barrels are coming more into use as we progress, and some of them in certain instances may not have given the best results. The reasons for failure may not have been distinctly known, and a case in point may be stated. We all know, of course, that a solution for barrel work should be higher in metal than for still tank work. The formula of the single-salts solution for barrel work is 42 oz. of single salts, 5 oz. boracic acid and 4 oz. sodium chloride. In this instance the solution had been used for some time, and a point had been reached where all the work was being rejected on account of insufficient deposits and all ordinary tests showed the solution to be correct, the hydrometer test showed 13 degrees Beaume and yet when a chemical test was made

it was found that the solution needed 80 pounds of salts to bring it up to standard, and the tank only held about 100 gallons of solution. The number of days the solution should be left in operation can be varied by the amount of work done in continuous operation. In small plants where plating barrels may be idle a part of the time this condition would not be so marked.

The description of the deficiency in metal of the solution as stated above shows that the hydrometer method of testing solutions as now used is not correct, and it also shows that a laboratory containing the essentials to make chemical tests is becoming a necessary adjunct to a plating room. The time is not far distant when all members of this society should be equipped to make these tests.

In the matter of efficiency three elements may be considered, the man, the equipment and the material; if either of these are lacking we do not get the most efficient results. I believe I can safely say that this society will continue to be the leading factor in raising the standard of all three.

Technically speaking very few plating plants have been installed along proper lines, or lines that will give the most efficient results, and each year more progress is being made in this direction. As we progress, engineers are becoming more interested in this work, and the time is not far distant when all plants will be installed along lines which are technically correct. Then the plater will not only know exactly what amount of energy he is using, or what amount of metal he is depositing, but will also be enabled to know the exact condition of his solution—all of these things combining towards better plating-room results and higher efficiencies.

In a great number of instances plating rooms are not properly wired as, owing to fancied economy, the leads and buss-bars from the generator are too small, contacts are not good and the branch wiring is either too small or imperfectly done.

Right along this line I wish to give an example on some recent installation work where a 3,200 ampere machine was involved. The extreme distance from the generator to the end of the tank row was 67.5 feet, and the distance from generator to the center of load 49.5 feet. According to the tables of carrying capacity three square inches of copper might be used in each bussbar, but, taking the ohmic resistance per 100 feet, the loss would have been 0.89 volts or 2,850 watts, or 14.85% of the generator rating. By assuming the value of one kilowatt hour of law voltage at 5 cents, including the losses in motor and generator, this loss would amount to \$1.14 per day of eight hours, or \$342.00 per year. If we doubled the cross-section of copper and used six square inches the extra weight of copper required would be 1,555 pounds, which, at 20 cents per pound, would cost \$311.00. By charging interest at 6% the extra cost upon the investment per year would be \$18.66, as against a saving per year in current of \$171.00, or a net saving of \$152.00. In two years this saving would very nearly pay for the extra copper used.

It will be seen by the above that the use of plenty of copper results in a saving of money.

The above is based upon the full ampere capacity of the machine and while the full capacity of any machine is not always used, the conditions can be taken as they are, and the results would be the same in relative proportions. I might state that in the installation referred to above four strips of copper 4" x ¼" were used in each bussbar.

In this connection the rheostat condition is to be considered. It is evident that there is no point in saving losses in the bussbars and then causing a big loss in the tank rheostats. The proper way is to use plenty of copper in the busses and reduce the voltage of the generator to a point just high enough to do the work, as every volt drop at 3,000 amperes means 3.0 kilowatts lost.

In the foregoing it has been my aim to convey some idea of methods by which, from both the technical and practical viewpoint, the efficiency of plating departments may be considered, and if I have succeeded I shall feel amply repaid for my efforts.

The Past, Present and Future of Electro-plating

H. J. RICHARDS,

Foreman Plating Department of the Koken Barber Supply Company,
St. Louis, Mo.

Mr. Chairman and Gentlemen:

When I heard the subject on which I am to speak to-night, I certainly felt honored. "The Past, Present and Future of Electro-Plating."

The committee not only think I know about the past and present of electro-plating, but they believe I know what is going to happen in the future. I am first to tell you what I used to know, then what I know and then what nobody knows.

Mark Twain once went to have his fortune told and they asked him what he would have, past, present or future. He said, "Well, you can't make me any more ashamed of the past than I am already, and I know the present—give me the future." But in electro-plating we don't feel at all ashamed of the past. A small room completely lined with shelves filled with primary batteries, furnished the plating current in the first shop I worked in, and one of my first jobs was caring for those batteries. We were plating only gold and silver and doing very good work which sold at a high price. I don't wish to throw any consternation into the ranks of these dynamo sellers, but I could demonstrate to any silver plater that fine work can be done with batteries, that is, where time and expense and trouble and profits are no object. We made our silver and gold

solutions right from the metal, as nitrate of silver and chloride of gold were high-priced.

The first nickel anodes I saw were of granulated nickel in small fragments which had to be used in bags with a wire running through them. The only buffs we had was a loose, whole disc buff so high in price that buffs were often home-made. The muslin was cut into squares, which were folded twice, bringing the centre of the square on one corner, then the corner was snipped off and the square sections put on the buffing lathe and turned down.

The cyanide of thirty years ago was better than any supplied to-day.

The first dynamo I ever used was, if I remember rightly, an old Eddy machine—series wound. My recollections of that dynamo made me think of the man who had a trotting horse who was sued by Jay Wilkes and damned by everybody who handled him. The salesman who sold that machine made his escape quickly and I don't believe he ever did come back. The way that thing would get smoking hot in a few minutes was simply amazing. It took a fiendish delight in burning work in spite of any resistance, and then the next minute it would quit generating, having apparently gone absolutely crazy with the heat. The installation was all faulty and the speed fluctuated considerably, but we didn't know that had anything to do with it. Any explanations that we could get on the matter were very lame. They were as lame as the schoolboy's explanation in answer to the question as to what caused the ocean to be salty. He said, "Because of the millions of herrings which swim in it." But the way a dynamo would throw the metal was a revelation to one who had worked with batteries. Necessity soon compelled us to learn more about dynamos and the way to use them. We were like Bobby Gaylor, who offered to help a friend carry a stove upstairs. "You go first," he said. "I did. But when he lifted, the top of that stove came down on my legs." Well, I *had* to lift, and we *had* to learn. We soon got better dynamos.

Passing through the successive types, we are all familiar with the modern low voltage plating generator. I may say here that in my opinion the biggest factor in the progress of modern electroplating is the development and improvement of the plating dynamo. It is always, however, left to the plater to get the best use out of his dynamo and the current it generates.

The present great variety and assortment of all kinds of plating and polishing supplies brings to my mind the story of a new preacher in a negro church. On his first Sunday he was particularly impressive in his prayer; he prayed for everything that it was possible for a man to want. On the way home one of the congregation said to another, "Don't you think that was powerful prayer, Brother Johnson?" "Ah most certainly does. Why, that man asked the Lord for things that the other man didn't even know He had." And we are apt to find that the supply houses have things that we didn't even know they had.

One of the great achievements of modern plating is electro-galvanizing. In the early days of gold and silver plating we were competing with a very high-priced article, sterling silver and solid gold, but the electro-galvanizer is competing successfully with what always was the cheapest and best method of rust-proofing iron, galvanizing.

The narrow anode now always used is a great improvement and mechanical or barrel plating is undoubtedly one great step in the forward march of electro-plating. Small work can be turned out by this method at a very low cost. It also gave the supply man a nice opening through which he could soak the plater with a lot of high speed, high-priced nickel salts. Analysis of some of these seems to prove the truth of the old adage, "there is nothing new under the sun," because their ingredients are according to formulas that have been long known and used. But they keep on coming, and we are beginning to think that where there is so much smoke there must be some fire. The merit or lack of merit of these salts will have to be determined in the near future by the American Electro-Platers' Society. We want the *very best* methods in all our works—that is *all we want*. We don't intend to be like a condemned prisoner who was asked on the gallows before execution, "Have you got anything you wish to say?" and he answered, "Yes, sir; I like to say a few words. I just like to say that this will certainly be a lesson to me."

The future of electro-plating, I think, will be an ever-widening field of usefulness. One thing which assures the future of electro-plating is a trait of human nature which never changes, the well-known fact that no matter how useful an article may be, to be a seller it must be attractive in appearance. It may be good, but it must look good or it won't sell.

Electro-plated cobalt may compete with nickel in the future; it is abundant, at present little used. It can be plated with the double salts as is nickel, and it has the appearance of nickel. It may possess good qualities to the electro-plater that we are at present unfamiliar with. The enormous success of mechanical plating and electro-galvanizing and the ever-increasing price of tin leads me to predict that in the future it will be up to the electro-plater to supply a cheap, efficient food container, that the sheet iron foundation of the present tin can will probably be electro-plated. That in the future the right article to attach to the tail of a fugitive dog or an incompetent employee will not be a tin can, but an electro-plated container.

Address and Paper

FRED J. LISCOMB,
Hanson & Van Winkle Company.

Gentlemen and Guests of the St. Louis Branch:

Perhaps I had better apologize to you before I start for what I am about to inflict upon you. On the other hand, perhaps you had better demand that your president and secretary do the penance, for it is because of their demand that I have consented to harrangue you to-night.

One incident in my own career as a plater will further explain why I have obeyed their demand. It will also show the relation of the supply house salesman to the plater. For several years before I became a peddler I was in charge of a plating room in a part of the country out of the beaten track of the salesman of our line. There was one man whom you all know, however, who used to hit the trail once a year and my calendar was always marked "Starrett" on the date of March 4. This was a reminder that he would arrive on that day.

Besides being isolated, in those days there were no "Brass World" and "Metal Industry" to consult, so when Starrett came along he was backed up in a corner and told to "talk, damn you, talk," and it was through his talk that I was able to keep in touch with the outside plating world.

Now, I have made it a rule of my life not to ask anyone else to do a job that I would not do, and if anything that I can talk to you about ever does even one of you men one-tenth the good that Harry Starrett's talks did for me, then I am more than willing to work nights and Sundays to get something to talk to you about.

Mr. Williams, "the boss," in his letter told me to talk on nickel solution experiments. A good motto to have hung where you can see it at least in your mind's eye is "Mind the Boss."

SOME EXPERIMENTS WITH NICKEL SOLUTIONS

In the presence of so many able platers, who have long since ceased to be experimenters, I greatly fear that it will be a difficult matter to describe the workings of a nickel bath and at the same time say something that will be new, unless we go into the question from an angle other than how to get out the largest quantity of work in the shortest possible time and at the least cost of production.

To describe experiments and put the results down as positive facts is likewise difficult, because in trying to duplicate the results it is necessary to have all conditions exactly the same. By this, I mean the E. M. F., the current, the strength, the temperature and many other details which at first glance seem so small that they can be neglected; but if we should neglect them through oversight or ignorance it would be impossible to keep within the limit of error.

For several months I have been making a study of the resistance of all kinds of plating solutions and their metallic content, and the cause of pitting and spotting out on stove work, and I am surprised to find that many of the supposed remedies have a tendency to increase the defect rather than to relieve it.

When we find a nickel solution pitting we ask what we shall do to stop the unsightly pits from forming on work that is otherwise very satisfactory. The usual answer is, that the bath has become impoverished and lacks metal. An experiment along this line shows that out of forty-one nickel solutions examined, all of which have been used on stove work in the Middle West, six of the samples were marked "Pitting." A volumetric test of the nickel content showed that these six pitting solutions contained the most metal rather than the least. From this I am inclined to believe that many times pitting is caused by the solution being too dense. At the same time, if an alkaline condition prevails the bath becomes sluggish and the hydrogen gas does not rise freely, but adheres to the surface of the metal being plated and acts as an insulator, preventing the metal-laden solution from coming into contact with the work and depositing metal at this point.

From this it would seem that the remedy for this trouble would be to dilute and agitate the solution, or reduce the voltage, or, better yet, a combination of all three.

Many stove companies have trouble with some of their nickel-plated castings developing a white, featherlike mould over certain portions of the surface after the stoves have been stored away in the loft. The knowledge of this fault makes it necessary to unpack many stoves before they can be shipped. This causes extra work and oftentimes much delay.

To overcome this spotting out, many experiments have been tried; they are too numerous to describe here. Having been called upon several times to solve the problem, an investigation was begun which extended over a couple of years. The conclusion finally reached was that the castings that spotted out in this manner were very porous, due to faulty gating and being poured with iron when too hot. Most of these castings are large.

The custom in many shops is to plate all of the large work early in the day, so the large castings, being hard to clean, are placed in the alkali solution over night, with the probable result that the porous iron soaks up the alkali solution, and, owing to the depth of the imperfection of the castings, it is not removed with the cold rinse water and scrubbing operations. The cold dips without doubt cause the castings to contract to some extent and seal the alkali within.

The cleaning solutions are in the main composed of sodium salts, most of which when exposed to the atmosphere lose their water of crystallization and form a more or less flocculent powder, more bulky than the original salt. This forces them out of the pores of the casting and, being of a dull white color, they disfigure

the highly buffed surface, making it necessary to again buff the article.

In the several places where this was noticed, the practice of soaking the castings over night has been discontinued, with the happy result that the spotting out has ceased to worry these platers.

The nickel solutions of five stove companies, some of the largest in the Middle West, using in all about 12,000 amperes, have been examined as to metallic content, in the hopes of ascertaining if possible what metallic strength of solution gives the best results and what voltage and amperage produce the whitest and most satisfactory nickel deposit for stove work.

The metal content in four of the foundries averaged as follows:

1	4/10	oz.	of	nickel	per	gal.
1	5/10	"	"	"	"	"
1	6/10	"	"	"	"	"
1	7/10	"	"	"	"	"

While many of the solutions were as low as 1 28/100 oz. per gal., only one was found that reached 2 oz. of metal per gal.

Of the solutions examined, the one that gave the most beautiful deposit contained 1 3/10 oz. of metal per gal. and was worked at a scant two volts. At this voltage, with a temperature of 70° F., there was no difficulty in reaching the deepest background—there was no sign of burning or roughness, and the work buffed very easily. This solution was said to contain nothing but double salts. A 12 oz. double sulphate of nickel and ammonia solution contains at 70° F. from 1 75/100 to 1 78/100 oz. of nickel.

I fancy that all of these solutions when new contained at least 1 3/4 oz. of metal per gal., the greatest percentage of loss being due to the drip. This is usually made up by adding a certain amount of salts dissolved in water when you have time.

It has occurred to me that a good way to keep nearer on a line so far as the nickel content is concerned would be to have a tank or barrel in which a new solution is kept made up, and at the end of each day make up the loss due to drip from this tank, adding a small portion of single salts to make up that portion of metal lost by *insoluble* anodes. This latter amount can only be computed by actual experiment.

Judging from the presence of chlorine in these forty-one solutions, many of the stove platers believe in sal ammoniac as at least 50% of the forty-one contained chloride in varying proportions.

A word on the use of the hydrometer may not be out of place here. This instrument is of little value as a guide to tell how much nickel the bath contains except when making a new bath, for the reason that when several chemicals enter into the formula they all tend to increase the specific gravity and the hydrometer does not measure the density of any one ingredient but of the whole. In using the hydrometer the accepted method is to look across the surface of the solution and read the scale at the bottom of the meniscus and not the top as many operators do.

A good way to use the hydrometer is to take a drop of oil and rub it on the glass tube covering the scale. The solution will not crawl up the scale when oiled, but remains on a level with the surface of the solution. The difference between the top and bottom of the meniscus is about one degree. As the instruments are calibrated at the bottom of the meniscus this must be correct.

Several samples of solution came to hand that had been exposed to a very low temperature, probably below 32° F., as the bottles were full of slush ice, much salts had crystallized out, the hydrometer stood at 4½° B.—it originally measured 7° B.

The specific resistance of this solution was 120 ohms at 40° F. Heat was then applied until 70° F. was reached and the resistance again measured and found to be about 50 ohms. We can see from this that the temperature of the bath plays an important part in nickel plating. A fall of 30° F. makes an increase in resistance of about two and one-half times, reducing the conductivity in that proportion, so that a solution through which 150 amperes would flow at 70° F. at a given voltage would fall to about 65 amperes at 40° F., increasing the length of time necessary to deposit sufficient metal considerably.

In cold plating rooms the bath should be fitted with lead covered iron steam pipes and fitted with insulating unions to take the chill out of the solution on cold days.

It will be necessary to refer you to the article in the Review entitled "What Are Conducting Salts?" for the data on specific resistance mentioned above.

Mysteries of the Past and Co-operation of the Present

OSCAR E. SERVIS,
Secretary Chicago Branch.

*Mr. Toastmaster, Officers and Members and Guests of the St. Louis
Branch:*

It affords me great pleasure to be with you on this occasion, not alone for a personal reason, but because I know every member of the Chicago branch would be delighted to participate in your generous hospitality; and I want to assure the members of this branch that it is only due to the long distance between us that there are not more Chicago members here to-night, but their hearts are with you all.

Any attempt on my part to give you a speech is idle folly, but it was impressed upon me on the way down here that I would possibly be called upon to say something. Had I known this before starting it would have kept me at home. I will content myself by giving you a few remarks and recollections of a fellow plater. The past year has shown a remarkable growth in our society, and let us hope it

will not stop until every competent and worthy plater is within the fold. The spirit of progress that has been so manifest up to the present time must not cease. The A. E. S. must grow, and will grow by the efforts of each and every one of us; there is no surer way to success than by hard work and close application, so I wish to impress upon each and every one of you, not to let success turn to neglect. If we have had prosperity in the past year in our society, let us remember it is only a milestone to our goal, and that we must ever go onward with staunch efforts to brave the breakers ahead.

When I consider what has been accomplished during our short period of existence it makes me feel thankful that this society was founded on right principles, and that the founders were broad-minded men who were not afraid to cut through the forest of skepticism and egotism, which seemed to be a prevailing disease in our craft.

In the past year several of the branches have taken a keener interest in the work, by engaging able instructors in chemistry to lecture and demonstrate the rudiments of H_2 , SO_4 , and so on, which is a stepping stone to the greater knowledge which can only be obtained by personal study and instruction. Wonderful strides have been made in both chemistry and electricity in the last few years, and unless we work and labor along those lines with an effort to master the theoretic as well as the practical knowledge, we shall soon fall by the wayside.

Do not think if you have a "snap job" at the present that there is plenty of time to learn—you may some day be out in the cold. Peace is only maintained by strong defences. So do we wish to encourage all who are not yet members to join our ranks and aid in this great work of progress, which cannot but prove profitable to you and me and the coming generation.

So far it has been demonstrated that the plater is intelligent and willing to improve; also, that assimilation of knowledge and co-operation of efforts are essential to success. This we have already realized at our meetings. A few years ago you would have scoffed at the idea of a society of platers being possible. At that time the plater as a rule considered himself somewhat of a conjurer, and, shrouding himself in his cloak of mystery, he boldly asserted that no "bunch" was ever going to get him "hypnotized" and compel him to divulge that valuable secret in obtaining "that blue color," on brass, which "he" only knew, but, in fact, had been given to the world by the great pioneer, Roseleur, a generation ago, and is still in daily use. The speaker remembers when he was first initiated into the mysteries of electro-deposition of metals. The boss, after weeks of exhaustive experiments, one day succeeded in plating a coating of copper on a piece of steel, and your humble servant gazed on in wonderment at the result (thus achieved), and after having served his master well for many months, his thirst for knowledge became abnormal and he bravely asked the boss how this was done. That "worthy," with a sly wink, most

emphatically informed the "scrubber" that he was not giving away his secrets, and thereafter he, being a cautious individual, saw to it that all labels or other marks of identification on material or chemicals used were removed as soon as they arrived.

When the cyanide copper sol. turned blue, it was to give her a chunk of that "white stuff"; when she blistered, give her some more, and when she refused to plate, give her still more; also, in all cases "give her another chunk of that white stuff." Finally the boss would stay after working hours, and, according to his version, "dope her up." One morning this same tank, having developed a leaky condition, some of the solution disappeared, and, being afraid that the boss would discover it (as he held the scrubber morally responsible for all such occurrences), your humble servant took the hose and administered a goodly amount of "aqua." "Oh, joy," the result was batch after batch of that nice red deposit turned out and no trouble. But when the boss arrived and was informed of the results thus obtained, as a compensation the scrubber was told in very abbreviated remarks and limited time to "fade away" for spoiling that valuable solution, and furthermore if there was any doctoring to be done "he" would administer the medicine—"so clean out."

This I cite to illustrate what has been a prevailing fact in our craft, and I am glad to know and to realize that this calibre of a plater is fast disappearing and his day of judgment has arrived.

The trade journals have proven a great factor in removing this mysticism which has so long existed and have paved the way for education and enlightenment of the present-day plater.

The plater of the future must be a man of theory as well as of experience, and as there are no more secrets in deposition of metals, he must be competent to manage his department on a strictly efficient basis. He must be broad-minded and quickly adapt himself to new conditions which may arise. The employer of to-day is on the alert for the man who is able to fill these requirements, and here at your meetings is your school of instruction. "The Review," that valuable little pamphlet which conveys to you the experience of some of the best platers in the country, will prove a valuable adjunct.

The manufacturers apparently have taken a deep interest in the association, which was much demonstrated at the open meeting and banquet of the Chicago branch last December, also by the number of members we have on the roster whose dues are being paid by their employers. These same employers must eventually be the gainers thereby, as the problems and discussions brought up at these meetings cannot but prove beneficial to their foreman platers who will strive to emulate their adversary's example.

I believe the branches in their respective states should seek proper legislation in order to better the sanitary conditions of the plating room, because the occupation even at its best is not a healthy one, and too much stress cannot be laid on the proper removal of poisonous fumes or gases arising from the various operations. This alone would prove a great accomplishment. Very little consideration

has been shown in the selection of proper locations for the plating and polishing departments. In many cases it may have been the plater's own fault and he has had to suffer the consequences.

I believe that the manufacturer is willing to extend his aid and co-operation in eliminating these unfavorable conditions, and this must invariably be to his benefit.

At last, a little social intercourse and the display of fraternal spirit can not but make friends and will tend to bury that evasiveness and skepticism which has so long prevailed. No plater who is ambitious and wants to advance can afford to be an outsider. It is only a question of time that will bring him to that primary realization that in "knowledge is power."

The American Electro-platers' Society

*J. H. HANJOSTEN, Supreme Vice-President

Mr. Toastmaster and Gentlemen:

I wish to congratulate you gentlemen of St. Louis on the splendid record you have made. With a comparatively small membership you have accomplished much. Keep up the good work and do not falter. Your reward will be sure, conscious of the good work you have done and of a duty you have performed your own self. Satisfaction will repay sufficiently for your labors. Keep it up.

Note the suggestion of Mr. Lamoureux that a small item neglected makes quite a run in a year and continues from year to year.

I am very glad to be with you to-night and I am happy to address you on a subject that is of so much interest to all of us.

Your secretary informed me that my subject would be "The American Electro-Platers Society," and I thought, when I received his letter, that you could very easily have found some one more able than I, someone who could more nearly do that subject justice.

For it is to us, and to our employers as well, a subject of vital interest, and I shall endeavor to make clear to our guests, who are not members of our Society, its aims and objects, and if at times I may seem to digress from my subject, it will only be to touch upon some matter that seems to be within the province of the subject assigned me, or to prod some hesitating someone into activity, to get him to take his stand where he belongs, or make someone think differently on some matters, than he has heretofore, or start him thinking on matters that he has not given a thought to, up to now.

Section 2 of Article 1 of our constitution reads: "The object of this society shall be the advancement and dissemination of knowledge concerning the art electro-deposition in all its branches. All laws and rules must be so formed that the society will promote no other object than the education of its members in all the principles of electro-deposition and the coloring of metals."

I quote the section in full because it explains the object of our society better and more fully than any words of mine could. Education, and the mutual assistance gained through education are the benefits we derive from our membership, and educating the plater in his profession is the first and greatest, and I may add the only object of our society. For may we not justly call the aid we get from our fellow members in helping us solve some problem that taxes our skill or experience part of an education that we get by associating ourselves in a society such as ours? True, our meetings promote good fellowship and a fraternal spirit that cheers the weary and raises the spirits of the down-hearted brother plater, who may have been wrestling with a problem that has puzzled him during the day, but that good fellowship and fraternal spirit is prompted by the knowledge that through his society the plater can appeal to his fellow craftsmen for aid that will help him overcome his trouble, and in his breast is kindled a desire to return the favor, and help some other, as he has been helped.

But a few short years ago the art of electro-plating was enveloped by a cloud of mystery so black and deep, that a Mississippi Valley fog would seem like high noon on a cloudless June day compared to it. And even to-day there are a few platers who still hug the delusion that their art is their own sweet secret, and some of them still strut around like the boy who knows something but won't tell, with the expression written all over their manner and bearing that says plainer than words, "I know something you don't know."

True this class of platers is much smaller than of yore, and with the onward march of progress is diminishing so fast that it will soon be with the snows of yester-year. And as platers they will be buried, unwept, unhonored and unsung. But let us leave them and not be too severe with them, for many of us remember them as good and kind men, men whom we in our younger years looked up to with admiration and wonder, for they knew something we did not know then, something that was very wonderful to us, when as youngsters we saw them mix solutions, and thought the miracles they performed the most wonderful thing our young lives had ever witnessed.

I have in mind one of them now, a kind, gentle and lovable man, soft spoken and gentle mannered, who was always willing to overlook our outbursts of youthful exuberance, his gentle rebuke always hit in the place where he aimed it, and he planted more good resolutions in my youthful mind than any other man I ever knew. I

always respected and loved him, and I shall honor his memory to my dying day. If he were living to-day, I believe he would be a member of our society, but I know it would break his gentle old heart to hear the things that were to him cherished secrets, so freely discussed in our meetings.

The breeze that has scattered the clouds of mystery before it, has gained in volume, until its strength has become that of a cyclone, and has swept before it every last vestige of the old orthodox beliefs, and in their place there is to-day the true gospel of education being preached by the American Electro-Platers Society. Its slogan "knowledge is power," is known and appreciated by every plater in the United States and Canada, be he a member of the society or not. But whether he is or not, the plater everywhere to-day recognizes the fact that if he wishes to keep step with the onward march of progress, he must educate himself in his profession, and more and more, throughout America, platers are beginning to realize that the education they need can be gotten through association and by exchanging with one another ideas and knowledge gained in practical experience.

It was for the purpose of exchanging ideas, of trading experience that the American Electro-Platers Society was formed. Under the leadership of our honored friend, Mr. Charles H. Proctor, a handful of men, fewer in numbers than the Branches of the Society now number, met in the Astor House in New York City, hardly five years ago, and there laid the foundation for the splendid structure, that was to become in the future a monument to their energy and progressiveness.

The early days of the new Society were not all peaceful and much opposition was met. Many platers, to whom the principles for which the new Society stood appeared sacrilegious, were bitterly opposed to it, and many openly spoke against it, prophesying dire calamities to the plater in general if a society that had for its primal object the dissemination of knowledge concerning the art of electro-deposition were allowed to live.

Then, too, there was the agitator who tried to force his way in. But the wisdom of the founders was great and their resourcefulness equal to every emergency. The society emerged from out of the gloom, its name as an educational society unsullied, and questions of wages and labor conditions were forever barred from discussion in its meetings.

For some time the New York Branch, as it is now named, was the only branch. It was the National Electro-Platers Association, and gradually platers all over America applied for admission as members. It soon became apparent to the members not living in New York City or its immediate vicinity, that to get the greatest amount of benefit from their society, they must form branch associations, and the Philadelphia platers, under the leadership of Mr. Fred C. Clement, our able Supreme Secretary, applied for a charter

to form a branch society in their city, which was granted by the National Body.

Within a comparatively short time, Rochester, Toronto, Indianapolis, Detroit and Chicago fell in line, and a short time later you gentlemen formed a St. Louis Branch. Since then several other cities have become the homes of branch societies, all having but the one object in view, that is, the education of its members in the art of plating.

In dwelling so persistently on the educational features of the society, I do not wish to give the impression that it is only by discussing platers' problems in our meetings that we educate or that the society is the only school that is necessary to give the plater a finished education, as a plater. But I do wish to impress on your minds the fact that in our meetings every phase of chemistry and electro-chemistry relating to the art of electro-deposition is discussed. Perhaps no class of men more fully realize the benefits of a technical education. Hence we encourage our members to study every detail of plating, and treat it as it should be treated as a science. A number of our branches hold their meetings in the laboratories of institutions of learning where experiments and demonstrations are made, and where men with both theoretical and practical knowledge convert theory into practice, and the plater with limited experience gains in a short time an amount of knowledge of his profession that it would take him years to obtain, by studying alone.

The experience of his fellows is his for the asking, and is at all times freely and cheerfully given, nor does the man giving of his store of knowledge miss it or begrudge it, for he knows that the many have more knowledge than one, and he appreciates the fact that his own application for enlightenment will receive the same consideration as that given to the question of his brother member.

Through the Supreme Society, which is the governing body, the fruits of the labors of the Branch Societies are spread among the members. The papers read at the different Branch meetings are published in the "Quarterly Review," and so reach every member, so that no matter where a member's home may be, he gets the benefit from the labor and researches of every branch. The Supreme Society publishes the QUARTERLY REVIEW and the BULLETIN, the latter a monthly periodical devoted to items of interest to the craft.

The Supreme Society also maintains a Bureau of Information to which any member can apply for information on any subject relative to electro-plating. It also maintains an Employment Bureau, through which members are aided in securing positions.

You will admit, gentlemen, that some labor is necessary to do all this, and yet we have no salaried officers in our Society. Every particle of work done is a labor of love, the only reward that we expect is that we will be better platers, the only reward that we give to our officers is the appreciation that we have for their work, and all their pay envelope from the society contains is "Well done, good

and faithful servant." I will not even say that we honor them by making them our officers, for the honor is all on our side. For we are truly honored in having such men as Messrs. Hogaboom, Barrows, Clement, Schultz and Taylor as Supreme Officers, and I know that every member appreciates the work they are doing, and they will find their reward in the grateful appreciation that is in the heart and mind of every member of the American Electro-Platers Society.

That the work the Society is doing is appreciated by manufacturers is becoming more noticeable every day, for many manufacturing concerns are urging their platers to join the Society and many of them pay their initiation fees and dues. The wise manufacturer knows that a good man is a good investment, and knows that a Society whose sole aim and object is the education of its members cannot be otherwise than worthy of support and encouragement. And we appreciate your appreciation. We want your good will, and we assure you that you will gain by being our friends.

The position of the average plater is an isolated one, insofar as men of his profession are concerned. He is in most cases the only plater in the factory where he is employed, and cannot go to any one for advice or help very easily. If, however, he is a member of the Society, he knows the man or men who can on short notice help him. Is not this of great value to any employer? How often does the work in the plating hold up an order, because something is wrong? It may be just a trifle, but it becomes a very important matter when perhaps it throws the entire factory system off the track, and yet, by calling on his brother platers for aid, it may be adjusted in a short time, and time, money and worry saved.

But our ambition soars even higher than just helping the plater out of difficulties. We want to place the plater and his art on a higher plane. We want the plater to treat plating as a science, for it is a science both difficult and complex. We want the plater to become so thoroughly familiar with the science of plating that the difficulties now so often encountered in his vocation will become things of the past. Will this not benefit the employer as much and more than the plater? It will mean increased efficiency, which in turn means a product of higher quality and a lower cost of production.

And we can attain our goal, and attain it only by associating ourselves as we have in an educational society, such as ours is.

Let me say to the plater who is still groping in the outer darkness to come on into the light. You will never regret it. You will be welcomed with open arms. If you are a pessimist, and see nothing but the wrong side of this world, I know of no better cure for your disease. For pessimism is a disease pure and simple. Somewhere in this grand old world there is a niche for all of us, and it is up to you to hunt it and find it. And if perhaps you don't fit in very snug and tight, get the right kind of nourishment and fill out. And the right kind of nourishment for you, brother plater, is education.

Learn to know your profession as you know yourself, and then learn to know it a little better. Get in with your fellow craftsmen, come to your meetings and learn, and life will lose its somber hue, and though the cornucopia in fortune's arms may never be tilted your way quite as much as you would like, remember that there are many things in this world besides money. And the greatest of them is the knowledge of duty well done, of services faithfully performed.

You may think that we have mapped out an extended program for ourselves. We have. But with your co-operation, and with the aid and support of the progressive platers of America, we know that we can carry it out. In answer to the question, as to whether we will attain our object, you will hear ringing through the United States and Canada, We Will.

*Foreman Plating Department, Globe Stove & Range Co., Kokomo, Ind.

A good oxidize to take the place of sulphuret may be had by saturating a lye solution with sulphur. It is said that this oxidize will last longer than the sulphuret oxidize.

A good black can be gotten by saturating a cyanide solution with arsenic. The solution must be saturated or the work will smut or smoke. Use hot and in an iron tank with a low voltage. Take the work out as fast as it is covered.

A good black may be had by using one pound cyanide and one-half pound arsenic to one gallon. Use hot, with brass anodes.

Use of Potassium Carbonate in Silver Solutions

BY FRANK C. MESLE*

EFFICIENCY in the plating room means not only the handling of the help to best advantage, but also having every gallon of solution in condition to get from it the best service possible.

I believe all platers will agree that the solution from which we can get a good deposit of a given weight in the shortest possible time, which means the highest current density (amperes per sq. ft.) and with the lowest electro-motive force, is the most efficient plating solution.

I am not sure that the electro-motive force is of much importance to the average Plater since most Platers seem to have enough current and use a portion of it heating their resistance coils.

It is not the purpose of this article to discuss the correct amount of silver or free cyanide that should be used in a plating solution, as this depends upon the class of work being plated—but my purpose is to present a few thoughts regarding the advantage of conducting salts, especially potassium carbonate (K_2CO_3) in a silver plating solution, and the extent to which they aid in producing an efficient plating bath.

Some seem to be of the opinion that the best silver solution is one that is "pure," *i. e.*, having only silver and cyanide in it, but even if this were true, it would be extremely difficult, if not impossible, to use a silver solution for any length of time and not have an increase of carbonate caused by the decomposition of the cyanide. It is the experience of most Platers that a new silver solution does not work well at first, but does better work when it has "aged." We assume this is because the "aged" solution has increased its carbonate content, hence works better. Carbonate, either potassium or sodium, increases the conductivity of the bath, and admits the use of a higher current density, thus giving a heavier deposit in less time. This, of course, is an increase in the efficiency of the bath, but this increase in the efficiency continues with the addition of carbonates only up to a certain point, and past this point, it increases the resistance of the bath instead of the conductivity, which, of course, means a decrease in solution efficiency.

It is frequently assumed that conductivity of a solution increases with the density, but this is not true of all solutions. Dilute Sulphuric Acid, for instance, has a greater resistance at a gravity 1.4 than at 1.2. (See Table No. I.)

The same is true of a Sulphate of Zinc solution. The resistance of this solution is 11.1 ohms per cubic inch at a specific gravity of 1.2709 and 11.5 ohms at 1.3288. (Table No. II.)

I am aware that a solution of high density is of advantage only in so far as the increase in current density will aid in laying on a smooth soft deposit of metal.

With this in mind, I give the results of some experiments we have made in which Potassium Carbonate played an important part.

A regular double silver cyanide solution was made up in the usual way with 4.50 oz. potassium cyanide per gallon and $3\frac{1}{2}$ oz. silver. The maximum current density that could be used with this solution was 5 amp. per sq. ft. A higher current density produced a rough or "burnt" deposit. A solution with the above mentioned amount of silver and cyanide should do good work with a higher current density. Ordinarily, we would say "it is a new solution, it will do better after it has been used for a few weeks" or "after it 'ages'" This means it would be used until cyanide is decomposed or potassium carbonate is added to the solution. We brought about an artificial ageing of this solution by adding potassium carbonate, putting in 4 oz. per gallon. This change admitted the use of 6 amp. per sq. ft. cathode surface. Another four ounces potassium carbonate was added; we now doubled the current density and received a soft smooth deposit of silver. The solution that at first would not lay down a good deposit at 6 amp. by adding 8 oz. potassium carbonate, the efficiency of the solution was increased more than 100%. Another four ounces potassium carbonate was then added, but this did not increase the efficiency of the bath 50% as might be supposed it would. The increase this time was only about 8%, as a good deposit could not be produced at a current density higher than 13 amp.

Further additions of potassium carbonate seemed to make little or no difference in the nature of the deposit at a current density of 12 amp. up to 20 oz. per gal., except that it did increase the resistance of the solution about 200%, 12 A requiring one volt with 8 oz. potassium carbonate per gallon and nearly 3 volts with 20 oz. potassium carbonate per gallon, with no improvement in the nature of the deposit. At 28 oz. potassium carbonate per gallon, we could not get more than 6 amp. per sq. ft. with 3 volts.

We might put it thus: the efficiency of a silver solution with 4.5 potassium cyanide and 3.5 silver can be doubled by the addition of from 8 to 12 oz. potassium carbonate per gallon, but if twice that amount is added, say 24 oz., the efficiency drops off about 100%, or in other words, twice as much work can be done in a solution with from 8 to 12 oz. potassium carbonate per gallon than in a solution without potassium carbonate, as in a solution with too much potassium carbonate in the same length of time.

Potassium carbonate in a plating solution is of advantage only up to 12 oz. per gallon.

Table No. III. will give a good idea of the results we are trying to tell about in the above.

RESISTANCE OF DILUTE SULPHURIC ACID.
(Jamin and Bonty.)

Density	OHMS PER C. C. AT				OHMS PER CU. IN. AT			
	0° C. or 32° F.	8° C. or 46.4° F.	16° C. or 60.8° F.	24° C. or 73.2° F.	0° C. or 32° F.	8° C. or 46.4° F.	16° C. or 60.8° F.	24° C. or 73.2° F.
1.1	1.37	1.04	.845	.737	.540	.409	.333	.290
1.2	1.33	.926	.666	.486	.524	.364	.262	.191
1.25	1.31	.896	.624	.434	.516	.353	.246	.171
1.3	1.36	.940	.662	.472	.535	.370	.260	.186
1.4	1.69	1.30	1.05	.896	.666	.512	.413	.353
1.5	2.74	2.13	1.72	1.52	1.16	.838	.677	.598
1.6	4.82	3.62	2.75	2.21	1.90	1.43	1.08	.870
1.7	9.41	6.25	4.23	3.07	3.71	2.46	1.67	1.21

RESISTANCES OF SULPHATE OF ZINC AT 10° C. OR 50° F.
(Ewing and MacGregor.)

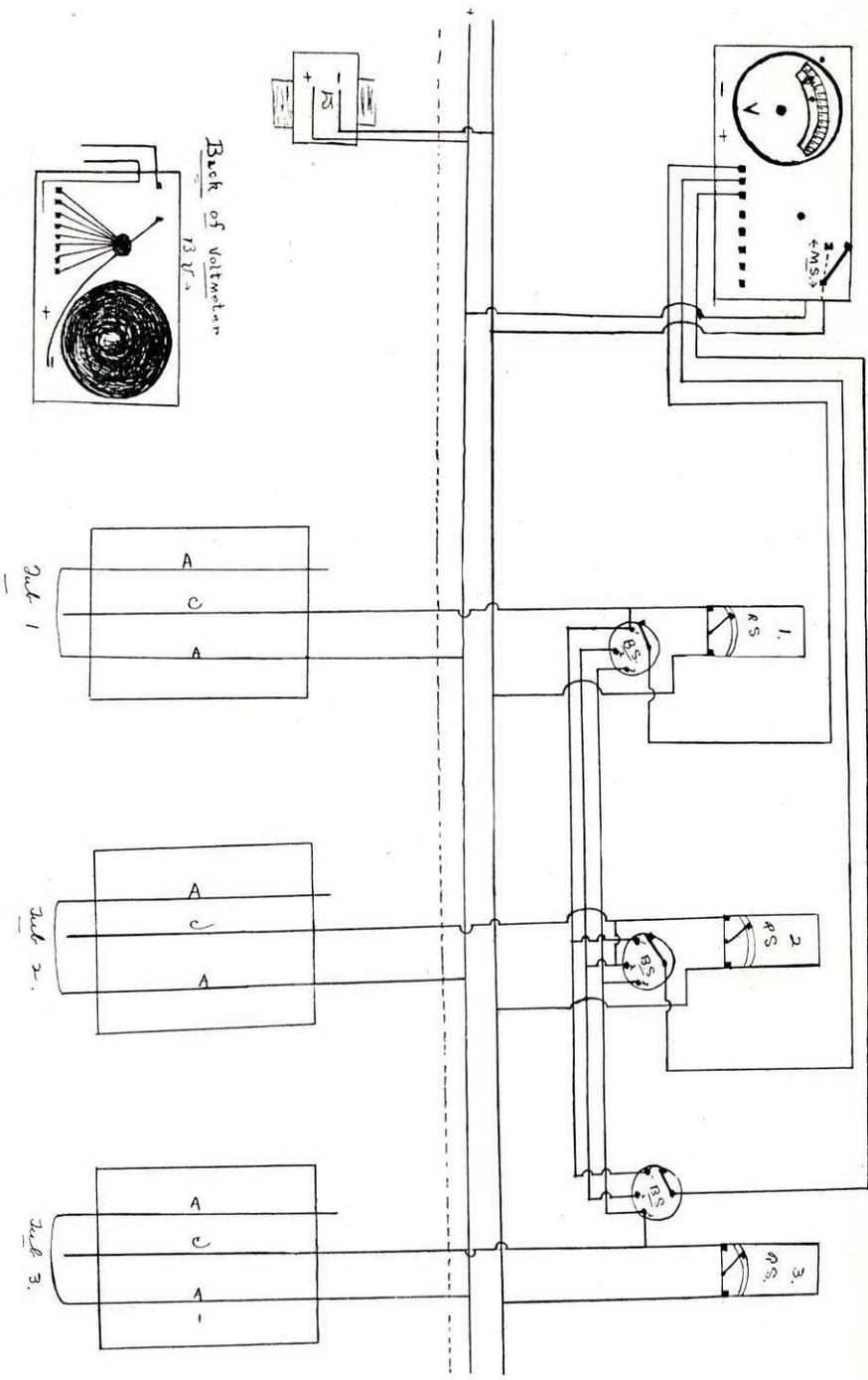
Density	Ohms C.C.	Per Cu. In.	Density	Ohms C.C.	Per Cu. In.
1.0140	182.9	72.0	1.2709	28.5	11.2
1.0187	140.5	55.3	1.2891	28.3	11.1
1.0278	111.1	43.7	1.2895	28.5	11.2
1.0540	63.8	25.1	1.2987	28.7	11.3
1.0760	50.8	20.0	1.3288	29.2	11.5
1.1019	42.1	16.6	1.3530	31.0	12.2
1.1582	33.7	13.3	1.4053	32.1	12.6
1.1845	32.1	12.6	1.4174	33.4	13.2
1.2186	30.3	11.9	1.4220	33.7	13.3
1.2562	29.2	11.5	Saturated		

From Taster's Electrical Engineers' Pocket Book. Page 1231.

Oz. K ₂ CO ₃ Per Gal.	Current Density	Volts	Nature of the Deposit
00	3.50	.55	Hard white plate.
00	6.00	.85	Very white and rough on ends.
00	9.00	1.25	Very rough and "burnt."
00	12.00	-----	
00	13.00	-----	
8	3.50	.45	Soft smooth plate.
8	6.00	.7	Soft blue plate, very good.
8	9.00	1.00	Soft blue plate, very good.
8	12.00	1.30	Soft blue plate, very good.
8	13.00	1.4	Soft blue plate, slightly rough on ends.
24	6.00	2.7	Soft smooth deposit.

With a pressure of three volts we could not get more than six amperes per square inch of cathode surface.

*Buffalo Branch.



Arrangement of Voltmeter

THE design on opposite page illustrates how my voltmeter is connected with the plating tubs. I bought a Model 57, Weston Flush Type Voltmeter, and material, and made my own voltmeter switchboard. The dimensions of my box are, 20 ins. long, 11 ins. high, and 5 ins. wide. The voltmeter and wires are all enclosed in box, which has been given several coats of black paint, both inside and out. No. 18 or 20 bell wire can be used in connecting up the 3-point bell switch. I used No. 14 insulated wire for the rest of the wiring.

By the use of the 3-point bell switch, it enables the plater to ascertain the voltage of each tub, at any one tub, by keeping each switch thrown open. For instance, if I stand at Tub No. 1, I will close the lever on point 1 of the bell switch to find the voltage of Tub No. 1; and without moving from Tub No. 1, I can tell how many volts Tub No. 2 is using by placing the lever on point 2; and Tub No. 3 by placing the lever on point 3.

The switches must be kept open when you leave the tub. That is, if lever of bell switch at No. 1 tub, is on point 1, and I am standing at Tub No. 3, I would not be able to tell what voltage I am using on Tub No. 3. I would first have to walk over to Tub No. 1 and remove the lever from point 1 and place it on point 3, before I would know how much current Tub No. 3 is using.

Any number of tubs can be operated on the same plan. Should the plater need fifteen tubs, he would then require a 15-point switch, which can be connected up in series, same as diagram.

By closing the main switch on voltmeter switchboard, you will ascertain the voltage the dynamo is generating. This switch should also be thrown open when you are through with it. However, the rheostat switches 1, 2 and 3, should be closed so that the current can go into the tub.

It must be understood that point 1 on the bell switches shows the current used in Tub No. 1. Point 2 will show the current used in Tub No. 2, and point 3 will show current used in Tub No. 3. So you will readily see how easy it is for the plater to walk to any one of his tubs and by moving the lever to points 1, 2 and 3, he can see how much current he is using at each of his tubs, without moving.

AUGUST WM. KONDER,
Philadelphia Branch.

A.—Anode.

B. S.—3-point Bell Switch.

C.—Cathode.

D.—Dynamo.

M. S.—Main Switch on Voltmeter Switchboard.

R. S.—1, 2, 3, Rheostat Switches.

V.—Voltmeter and Voltmeter Switchboard.

B. V.—Back of Voltmeter Switchboard showing how wires are connected.
They are all soldered to a brass plate.

Newark-New York Banquet

THE fifth annual banquet of the Newark and New York Branches took place on the evening of February 21st at the Marlborough-Blenheim Hotel, New York City. About one hundred and seventy guests took advantage of the hospitality offered by these branches and they each and every one had an enjoyable evening. At the speakers' table were Mr. Charles H. Proctor, Mr. George B. Hogaboom, our Supreme President, Messrs. Thomas B. Haddow and J. A. Stremel, President and Vice-President of the New York Branch; Mr. Horace H. Smith, President of Newark Branch; Dr. W. A. Jones, Professor William Wiener, Principal of Newark Central High School and our old friend, Smiling Bill Schnieder, chairman of the Banquet Committee.

President Haddow acted as toastmaster until his voice gave out and then President Smith took his place. The affair was most successful in every respect and the committee desires to thank all who helped make it so.

Mr. Joseph Walters, of Richmond, Va., read a paper on "Electro-Plating: Is it a Trade or a Profession?" His address was most interesting in every respect and made most of the members present feel proud of the fact that they are platers.

Professor Wiener's talk was most interesting and he stated that in order to be successful he must follow the business for which he was best fitted.

Mr. Charles H. Proctor, founder of the Society, spoke a few words appropriate to the occasion and congratulated the two Branches on the progress they had made. Supreme President George B. Hogaboom then recounted the objects and benefits of the Society.

Mr. Wm. Schnieder then spoke interestingly of his various experiences and stated that in order to have a highly efficient plating department a plater must and should have the same advantages as any other part of the shop. Vice-President Stremel's speech was interesting and is published below.

The badges used were furnished by the Maas-Waldstein Company, Newark, N. J.; the menu cards and souvenirs were furnished by the Celluloid-Zapon Company, the Roessler & Hasslacher Company provided for the printing and the Celluloid-Zapon Co., Egyptian Lacquer Co. and Roessler-Hasslacher Company furnished the cigars. The Metal Industry supplied the registration staff and furnished the type machine.

The display of the work done by the members was so good that it caused many to scratch their heads and say, "Gee, I wonder how that was done."

Vice-President Stremel's Speech

Fellow Members, Guests of Honor and Friends of our Society: It affords me great pleasure to greet you this evening on behalf of the New York and Newark Branches and bid you all welcome to partake of the good things which have been prepared for us, and which are offered, and I trust will be enjoyed with the same goodly spirit as the dusky southerner breaks bread with the passing stranger.

At this, our fifth annual banquet, we no longer meet as the parent body of this grand society, which has for its aim the educational uplift of its each and every member, but humbly we take our place in the rank and file of the Branch Societies, having had the paternal yoke lifted from us by the formation of the new Supreme Body, representing all of the various Branches.

I avail myself of the opportunity to publicly commend the members of this body who have persevered in the work of developing and guiding the Society to its present lofty position in the eyes of the plating fraternity.

The work was hard and as the Society grew, business likewise increased and much time which might have been given to the discussion on plating, finishing, etc., was sacrificed to problems of organization so that others might learn of and be benefited by the Society. Now that we have been relieved of this responsibility we find that our progress has been greatly impeded while other Branches have flourished and established methods of educating themselves in the theory and chemistry of electro-plating and finishing. A widely scattered membership also is ours, it ranging from coast to coast, from north to south of the States, making it impossible for many of its members ever to attend a meeting. And the withdrawal of the Newark members also cut into our ranks and we lost several earnest workers by the formation of that Branch. Then, too, business takes some of our best men to other parts of the country and we greatly miss the regular attendance of such live wires as our Founder and First Past President, Mr. Chas. H. Proctor; Supreme President, Mr. George B. Hogaboom; Mr. Percy S. Brown, Mr. Schneider, Mr. Sliter and our elected President, Mr. Thos. B. Haddow.

But we have been leaders in the past and hope to continue as such and plans are now under way in our New York Branch to secure a laboratory and the services of an instructor that its members may become proficient in both the theoretical, chemical and practical sides of electro-plating. Therefore, I extend this evening a most cordial invitation to all Foreman Platers who are as yet not members to come and join us and share the benefits to be derived from a membership in the A. E. S.

And now I hope you will all have a most enjoyable evening and listen to what the speakers of the evening have so kindly agreed to say to us.

Dayton Banquet

On Wednesday evening, February 24, Dayton held their first annual banquet in the Banquet Hall of the Y. M. C. A. This Branch deviated somewhat from the course usually followed by the Branches and had their wives and friends present in order to make the evening more enjoyable. Owing to the inclement weather and heavy snows, the attendance was slightly less than the committee had anticipated. However, that which was lacking in numbers was partially made up for in the good spirits and enthusiasm displayed.

Letters of regret were read from Supreme Vice-President Hansjosten and Founder Charles H. Proctor on their inability to be present, but their well wishes were present nevertheless.

After the good things had been partaken of, the Chairman of the Banquet Committee, Mr. A. Lamoureux, introduced their president, Mr. Walter Fraine, who acted as Toastmaster for the occasion. President Fraine, in a few well chosen words, spoke of the feeling of pleasure it gave him to see so many present. "This showing," he continued, "speaks well for the future of the Dayton Branch."

Mr. A. Lamoureux, Secretary of Dayton Branch, then outlined a brief history of this Branch and spoke very encouragingly of the future. He then proceeded to read a paper written by his brother, Mr. E. Lamoureux, of the Chicago Branch, on "Efficiency, Business and Technical Ideas of Electro-Plating." This was received with much enthusiasm as Mr. E. Lamoureux was responsible largely for the formation of this Branch.

Impromptu remarks were made by Messrs. Henry A. Creamer, of Springfield, Ohio; Joseph Keyes, proprietor of the Dayton Plating Works; Forrest Hartzell, proprietor of the Crown Manufacturing and Plating Company; Elmer Stephens, Wm. Liddy and Robert Sumans, librarian of this Branch. During the evening, the Jones Brothers Quartette rendered selections and they were accompanied on the piano by Mr. Norman Jones.

Dayton has been organized for only one year, starting with thirteen members and at present having an enrollment of twenty hustling members. The future of this Branch looks exceedingly bright and a banquet to the manufacturers of Dayton will be given in the near future.

Duplex or Acid Copper Solutions

ROBERT SUMAN*

A NUMBER of formulas have been given for acid or duplex copper solutions, and I will endeavor to bring out some of the points regarding the same, hoping they will benefit some of our members. Some of these formulas have worked perfectly, while others have proven faulty, although they may have been worked all right by the inventor.

I have always used the following when making a new solution, and invariably have obtained excellent results; I have also noted the following faults and have found the remedies as they are given below. They may not work the same under other conditions as they have worked for me, and other platers may not have the same failures or observe the same faults, as it is often the case that one plater may use the same formula that has been worked successfully by another plater, and find it impossible to obtain good results. I think this has happened to a number of us. Oft' times a plater may have trouble with his various solutions and coloring, and his position necessitates immediate results and production, but after this has been obtained he continues trying different methods, hoping for further improvement. He should not be afraid to seek the advice of some other member who knows, nor be afraid to show his ignorance, as none of us knows it all, and it has happened that continued useless experiments have resulted in the loss of position.

A fairly good solution is as follows:

Water—1 gallon.

Sulphate of Copper— $1\frac{3}{4}$ pounds.

Sulphuric Acid—2 ounces (approximate).

However, I personally have never used this solution, but generally hang the Sulphate of Copper in sacks in the tank until the hydrometer stands at 17 or 18, when I add sulphuric acid until it reaches $1\frac{3}{4}^{\circ}$ more. I then add about one-quarter ounce of alum per gallon, and I have found this to be a good solution which generally starts out right.

Below I enumerate some of the faults which most of us have been up against, and the remedies that I have applied, which may be of some benefit to those not having had the experience.

Rough spots or "pimples" may be caused by a stirred-up solution, small particles of undissolved copper floating from the anode, or too strong a current. To cut out the current or strain the solution usually remedies this condition.

The deposit may be smooth and free from the velvet appearance that is desired on some classes of work. This may be caused by the solution being too low in metal, when sulphate of copper and a small amount of sulphuric acid should be added.

Spots may appear on the surface which refuse to plate, which

may be caused by finger marks or grease, or the article being porous. If the latter, the pores may be filled with grease. If the article is of iron it may not have been sufficiently plated in a cyanide solution or nickled. Streaks sometimes appear on the work, which may be caused by the grease in the pores or a zinc spot. Streaks are sometimes caused by the current, which can be controlled by the rheostat. I have found that a good remedy for porous metals is to wash them in gasoline or naphtha and dry out in sawdust, or boil well in lye or potash.

The deposit may be coarse or grainy, and unable to stand the buff, when it may possibly brittle off. This may be caused by too much metal being deposited or forced on, or sometimes too much acid, or the edges may be too close to the anode.

Sometimes the deposit may be dark red on the edges and bottom, caused by the acid not being agitated enough or the current being too strong. These conditions also cause the deposit to be dark red and spongy, and the addition of a small amount of acid sometimes remedies this.

Too much metal in the solution may cause the plate to become spongy and not hard enough to buff. The addition of a small amount of acid will remedy this.

When the deposit is not thrown on fast enough a small amount of sulphuric acid should be added or additional current used.

Instead of the bright appearance desired a brown scum may appear on the plate, caused by heavy deposit, weakness of conductive force, or a dirty solution. A small quantity of alum will brighten the deposit; hyposulphite of soda, in small quantities, is also a good brightener.

When the plate is brittle, caused by the solution being too low in metal, the addition of a small amount of sulphate of copper or carbonate of copper is advisable.

A number of platers suggest adding glucose, molasses or gelatine, as these ingredients seem to give the solution a body and to act as a filter, settling at the bottom of the tank. When cleaning out his tanks the Plater will often find them lying on top of the mud or sediment which has accumulated.

When I have known the metal and acid to be in the solution in the proper proportions, and it has worked faulty, I have found that filtering the solution has remedied the trouble.

I have found the "Electrolytic" to be the best anode, as it seems to feed the solution more freely than the sheets, and also acts as a better conductor, as the warts on them give more points of contact to draw from, and the plate is more malleable and soft. I would suggest that if the manufacturers start the same kind of anode for nickle, that they make it rough, as the Plater does not care for a smooth-surfaced anode.

I think the plater's troubles would be partly eliminated if he had less iron deposited than at present, as he would get rid of the mud in his tank and also obtain a whiter deposit.

We can use this solution hot, when it makes a faster deposit, but it must then be filtered more often.

The voltage depends upon the amount of the load and the density of the solution, but I have been successful with a voltage of 1 or $1\frac{1}{2}$ volts.

I do not think that I have entirely covered this subject, and therefore hope that "the other fellow" will help by giving us the benefit of his experience and views.

*Dayton Branch.

Is it a Disadvantage to Pickle Castings that are to be Plated?

By ARTHUR O'KEEFE.

IS it a disadvantage to pickle casting that are to be plated?

I would say—decidedly, yes.

The pickling of castings as far as plating is concerned is a great disadvantage, as well as an extra expense, adding nothing to the beauty of the deposit. It has a tendency, if not thoroughly neutralized, to turn the deposit yellow in the background and causes the extra expense of plating it the second time in order to cover and whiten the deposit, to say nothing about having the solution saturated with hydrophloric acid, which, as is well known, does not improve the working of it.

The pickling of castings, as far as the softening of iron is concerned, is a great advantage in the polishing department, softening the iron to such an extent to make it possible for the polisher to scale his work with the ordinary amount of wheels, which otherwise would be impossible.

Of course, all this trouble could be eliminated if the laborers performing this work of pickling understood the reason for it, but unfortunately this class of work is performed by unskilled laborers who are not familiar with the English language, consequently it is impossible for the person in charge to explain the reasons for the operations, and this accounts for the acid not being neutralized in the pores of the metal.

Another cause of this trouble is that the work is being pickled a portion of the time in nothing but water, owing to the fact that the pickle, through neglect, is not strengthened, while on other occasions it is neutralized in nothing but water.

There are remedies for all these troubles, but they lie with the manufacturers themselves and as the question of money is involved, it is not at all likely that any efforts will be made to improve

the conditions. Nevertheless, I would like to offer a few suggestions along these lines.

If it is profitable for the manufacturer to use that grade of iron, let him confine it to the black castings only, that is to say, use it for all castings that are not to be plated and use a better and also a softer grade for ornamental work or work to be nickle plated. By working along these lines, the use of hydrophloric acid could be done away with entirely, an item of from seven to ten dollars per day and a better grade of work would result.

This subject was prompted by a question asked by some member of the St. Louis Branch, striking me very forcibly at the time, due to the fact that I have had trouble of the same character.

President Detroit Branch.

Silver Plating

By J. E. YOUNGER,*

Foreman Plater Elgin Silver Plate Co.

I PRESUME all of you understand the underlying principles of this subject and I sincerely beg to be relieved from the embarrassing position this article finds me while submitting to you; not given in a suggestive nor in an instructive nature, but given in a spirit that befits me best at this time,—the spirit of A. E. S. To you, my Brother Platers, I will be pleased to rely on your kind indulgence for a few moments. Necessity compels me and necessarily confines me to that well trodden path which brings me face to face with that old familiar subject, Silver Plating. In selecting this as my subject I believe I owe an apology in presenting one that has been written about as much if not more than any other subject pertaining to the art of electro plating; but I think it still remains one of the most interesting subjects in the world of electro deposition of to-day. Silver is considered one of the most prominent metals in electro deposition processes. Why? First, because silver is one of the virgin metals, significant for its exquisite color, capable of such a high lustre and brilliancy when the proper method of polishing is employed, either on the metal itself or on the deposited surface; second, because it is one of the three distinct colors of metals of the world—thus, gold is yellow, silver is white and copper is red; third, because of its useful and far superior qualities as a non-corrosive metal for silverware, domestic, commercial and many other purposes where no superior substitute has ever been offered, and because of the intrinsic value of the metal itself. Although in actual amount of metal, there can be no comparisons made, with some of the inferior metals in amount of metal deposited, but in actual value will equal, if not exceed, any other metal in actual value of metal deposition.

There are a great many different salts of silver. Some of the most common are, the chloride, nitrate, carbonate, oxide and sulphides. The sulphite and acetate and other salts have been tried, however, for electro plating, but the one that has stood the test of time and gives the best satisfaction is the double cyanide of sil. and potassium. There are a number of methods of constructing a silver plating solution and each plater has as many of his own private opinions in regard to making and maintaining the solutions as there are different methods. A few of these methods I will endeavor to explain as I proceed with this article. There are also a number of peculiar circumstances in connection with the deposition of silver, such as the composition of the electrolyte, specific gravity, tempt., current density, or actual amount of current entering a certain amount of surface in a given amount of time, and also the surface of the article to receive the deposit. From actual experience with a number of electro plating baths not necessarily sil. I have observed that these circumstances present themselves in about the same way, but as silver is the subject at hand, I will endeavor to confine myself accordingly. The circumstance which has the greatest effect on the quality and purity of the deposited metal is the composition of the electrolyte; the circumstance that affects the deposit the most is the current density, in other words, the amount of current entering the cathode or receiving surface in a given time.

In silver plating the operator must exercise considerable care in handling the proper and necessary amount of current, as the difference in the solution temp. and amount of cathode surface requires to be electrolysed at a different rate before satisfactory results can be obtained. From experience gained through considerable silver plating I am convinced that a perfectly smooth, bright surface is the best to receive a silver deposit. If the surface should be rough, therefore the deposit will be rough also. If of an irregular shape, with many sharp protruding points, etc., it will require very careful manipulation of rheostat and the correct amount of anode surface in proportion to the cathode surface must be maintained before any degree of success can be accomplished. As the deposit increases in thickness it has a tendency to become uneven, and in nearly all cases will lose its reguline character and brightness. The edges of the cathode which receive the thickest deposit are the quickest affected. Therefore it will be necessary to resort to a mechanical operation such as scratch brushing or buffing in order that the smooth surface will be restored again. It is customary for a great many platers to use a silver solution containing one-half oz. or less of silver to the gal. and add a great excess of potassium cyanide to make it conduct freely. There are some advantages in operating solutions formed in this manner. It also has its disadvantages. The only advantage is in its being comparatively inexpensive in its first formation. Solutions formed in this manner will deposit very rapidly and yield metal of an average character, but when that fine unsurpassable white deposit, so characteristic of this metal, is

desired you will find this formation to be greatly in error. Solutions so constructed are very troublesome to operate, especially in hot weather. The anodes dissolve with great rapidity on account of the great excess of potassium cyanide. A good depositing solution should dissolve the anodes freely, however, and at the same time contain the proper proportion of silver to the gal. or solution, and have very little effect upon the base metal, because it is such metal we wish to deposit upon. The addition of silver salts to potassium cyanide solutions may be worthy of mentioning at this time in regard to the effect some of the various salts produce. With the exception of the cyanide of silver salt most all other salts have some effect when added to potassium cyanide solution. For instance: If we should add the oxide of silver to a potassium cyanide solution some of the cyanide will be converted into potassium hydroxide or caustic potash. If carbonate of silver should be added to potassium cyanide solution potassium carbonate to a certain extent will be the result; the same by adding silver chloride potassium chloride will be formed and so on, with many other salts of silver. Each of the salts, especially the chloride, diminishes the action of the electrolyte upon the anodes, decreases the dissolving power for cyanide of silver, and will to some extent act on the cathode surface, also in many instances interfere with the adhesive properties of the deposit. Some electroplaters are inclined to believe that these salts are not injurious to a plating bath, but I think some of you will agree with me that they are highly detrimental. For illustration, excerpt from the works of an authoritative chemist: One hundred ounces of silver chloride added to a potassium cyanide solution will produce about 69 ounces of potassium chloride as an impurity in the solution. Of the same amount of silver converted into silver nitrate will produce 93 ounces potassium nitrate as an impurity when added to a potassium cyanide solution. Therefore in constructing a silver plating solution the double cyanide of silver and potassium salts from a chemical standpoint are far superior to any other silver salt for making and maintaining a silvering bath. After a brief description of a few of the circumstances connected with silver plating I have arrived at the most prominent circumstance of all, the making or forming of the electrolyte. Some of the text books on electro plating give a number of ways of forming silver solution, but experience prompts me to believe that there are only two reliable ways of doing so. Chemically and electro chemically. I will endeavor to explain a few things in forming a solution in the electro chemical way, or dissolving the silver direct from the anodes. The silver anodes for this method should be "fine" or as near pure as possible to be had. This method I know will seem ancient or prehistoric to some of you, and I believe I could be easily convinced of the fact that there are but a few platers of modern times who still employ this method of forming a depositing bath but nevertheless is considered a very good method, especially for small solutions where plating is done on a small scale, and where the plater has not the proper place or

facility for precipitating his silver chemically. There are not many accessories required for dissolving the silver from the anode. A few porous cups, size and number depending on the amount of solution that is to be made; a piece of heavy copper wire coiled up to resemble a close spring, with a hook formed on one end will act as the cathode. The coil should be about one-half the diameter of the cup, with plenty of space between coil and cup and about one inch shorter than the cup that is to be used. These are round cups that I have reference to. Cups of other shapes can be fitted up accordingly. In suspending cups in position all that is necessary is to put a small hole about one-half inch from top or upper edge, exactly opposite from each other, a small wire attached to each hole and formed into a suitable hook so it can be hung on the cathode or negative rod, having the porous cup properly fitted up. Next fill tank, or jar, with cold water to about two-thirds the depth that is to be used for plating. Then add four ounces K C N to each gallon of water in tank. After the potassium cyanide has thoroughly dissolved get the exact weight of anodes, hang in the solution in proper position, connect anodes with positive rod. Then with the proper amount of K C N in solution, anodes in proper place, with porous cup suspended from the cathode rod to the correct depth, so none of the potassium cyanide solution can enter the cup. Then place the coil, or cathode, inside of cup so they will hang suspended from the cathode rod, entirely free from touching the cup. Now add a concentrated K C N solution to cup, turn on the current. As much current as possible should be sent through the solution without causing too much gas to generate, at either pole. If no action takes place inside of cup add more potassium cyanide to cup, which will increase the action. The current should be continued until about $1\frac{1}{2}$ ounces of silver is dissolved from the anodes. This can be determined by weighing the anodes again. If the proper amount of silver has been dissolved and the solution gives a nice, fine-grain, white deposit the solution should be all right. Fill up tank to the required depth. It will now be up to the operator to use his good judgment in regard to the amount of current necessary to get desired results. If after using the solution it becomes low in metallic contents, the porous cup suspended for a short time will bring the solution to the right metallic proportion again. The color of the anode is considered by most operators to be the best guide in operating a silver solution. The anodes while the current is passing should be of a gray color, then the solution is O. K., but when the current is interrupted they will turn to a perfect white color. If the anodes appear white while the current is passing this will indicate too much K C N in solution. It is then necessary to add a silver salt or draw in enough metal from anodes by using the porous cup. If the anodes assume a very dark color while the bath is in action and persist in remaining so, this indicates a deficiency of potassium cyanide.

In making solutions by the chemical process I will endeavor to confine myself to two of the most extensively used, the double cyanide of silver and the chloride; both of these salts have predominating features, in fact, one will give the most satisfactory results of any silver salt and the other quite the easiest to prepare of many of the silver salts. Preparing the double cyanide of silver is not considered a very difficult operation, but will require a little more attention than in preparing the silver chloride. Some operators form the cyanide of silver by generating hydrocyanic acid gas through a solution of silver nitrate as long as a precipitate is formed. By this method a slightly purer salt can be obtained than by the regular method of precipitation. The fumes are very dangerous to inhale in preparing the silver in this manner. In making the double cyanide of silver there are a few points of importance worthy of mentioning. One in particular is watching the neutral point. In dissolving the metallic silver it is necessary to use a perfectly clean nitric acid of commercial strength, etc. A great many operators, in fact all of the text and chemistry books, advise us to use about one-half water when making or cutting down silver. I beg the privilege to state that when cutting down silver I never use any water whatsoever. The way that I have found to be very satisfactory is to take the amount of silver we wish to dissolve, depending on the condition of the bath, the amount of work being plated, etc. Next, select a good sound jar, as heavy as possible to be had, one that will with convenience hold the combined contents of acid and silver and still have half of the gas for the action of silver and acid. The silver must be cut up into small pieces to obtain best results. The amount of acid that will be necessary to dissolve the silver should be put into a hot water bath and heated as hot as possible. After this has been accomplished add the metallic silver a little at a time. Ebullition will not be very great at first but will increase with the amount of silver that is added at a time. In dissolving silver in this manner it will be particularly necessary to have about half of the jar for the solution to rise in while in action. This is a very quick method of cutting down silver as the writer has cut 200 ounces in this manner in twenty minutes after the acid had become hot. If the solution in action should have a desire to boil over all that will be required will be to add a little cold water, which will check the action. After the silver has been dissolved add about 8 or 10 gallons of water, boiled or filtered, but necessary to be distilled. This is the reduced silver nitrate solution. In preparing the double cyanide of silver prepare a very concentrated solution of KCN and add to the above mentioned solution enough to throw the silver down as a white precipitate, resembling silver chloride somewhat but with this difference in preparing, that when the silver is precipitated with HCl or $NaCl$ an excess of either will do no harm, but if any excess of KCN should be added to the silver, as silver cyanide, the silver will be redissolved. Therefore it is up to the operator to watch the neutral point. That is, when all the silver is precipitated, then to

stop adding the K C N solution. Here it is very easy to commit one or two errors. First, to not decompose all of the silver nitrate or redissolve some of the precipitated silver cyanide by adding an excess of potassium cyanide solution. I believe that it is universally known that these various salts are very insoluble in water. Therefore we can pour or syphon off the water above the settled silver cyanide; by repeating the operations a few times we can free the cyanide of silver from any chemical salts that are not only unnecessary but detrimental to a plating solution. After sufficient washing of the precipitated cyanide of silver enough concentrated K C N solution should be added to just redissolve it. The solution must be well stirred while adding the K C N solution; after the silver cyanide is all dissolved add a little K C N to act as free cyanide. The chemical action which takes place in the solution is, the silver combines with the cyanide forming cyanide of silver the freed nitric acid uniting with the potash of K C N forming potassium nitrate. In preparing the chloride of silver the same method of cutting down the silver is used as described for the double cyanide of silver excepting that it is necessary to precipitate with hydrochloric acid or common salt, sodium chloride. The common salt is much to be desired, or preferred rather, for precipitating the silver nitrate. Some electro platers in preparing the silver chloride will add the natural salt in its granular form to the silver nitrate solution, but this is not the correct way of doing it from the experience that I have had with preparing this silver salt. The best method that I have found is to thoroughly dissolve all of the grain salt in cold water, then when adding the salt solution to silver nitrate solution there can be no chance of any of grain salt to enter the pockets or sell of the precipitated silver chloride. In adding the salt well dissolved it not only makes washing of the silver chloride easier and quicker but the final results will be better. If the grain salt should be added to the silver nitrate solution it will be with great difficulty that all of the salt can be washed out of the solution. Therefore another foreign salt will be added to the plating bath. After several washings the silver chloride will be ready to add to the plating bath direct. With the free cyanide in the plating solution the silver chloride will soon dissolve in the solution. If hot water should be added to the nitrate of silver solution and salt it will have a tendency to crystallize the silver chloride and will require more K C N to dissolve it. By using cold or lukewarm water a more soluble silver chloride will be obtained. In washing the silver chloride at times will turn dark and resemble mud. Silver chloride in this condition as far as I have observed has no material effect on the working conditions of the silver depositing bath.

Taking all of the different circumstances combined and reduced to three will be all that is necessary to produce the desired results. First, have your silver solution free from acid and salt; second, the proper regulating of the current; and third, a little judgment on the part of the operator while operating the solution.

*Chicago Branch.

Casket Hardware

BY J. E. YOUNGER

Foreman Plater Elgin Silver Plate Co.

IN this short article I will endeavor to present a few things in connection with the manufacturing of Casket Hardware.

The most extensively used metal for this class of goods is known as the Antimonial Lead Alloy, consisting of 87% Lead and 13% Antimony. Although there are some variations in this alloy, it is generally conceded that the 87-13 alloy gives very satisfactory results. It is with great infrequency that we find published detailed articles pertaining to the coloring and plating of soft metal, and I believe I am justified in taking the liberty to state that the man that is plating this metal continually, day after day, in quantities, is the man that is in a position to comprehend some of the little, peculiar and troublesome characteristics of this alloy. In handling soft metal the utmost care must be exercised at all times, especially if the metal has been polished to a surface, as the surface is very easily scratched, and if handled to any extent, will leave finger marks, etc.

To start the different processes in connection with line of goods, I will attempt to proceed with the casting, frequently termed molding. The molds are composed of a suitable Bronze Alloy and generally made in halves; one-half of the mold is held up right and fastened to a frame or holder; the other half of the mold has a handle attached so it will be convenient for the operator to open and close the mold. The molds, in order to produce satisfactory results, should be polished smooth, but not necessarily bright. There are a number of methods of preparing the molds for receiving the metal; the method most generally adopted is termed the smoked surface method. In preparing the molds, the molds are taken from their respective place of keeping and are next subjected to a slow heat. The object in heating the mold is to expel all traces of moisture as it is particularly necessary that the mold should be warm and absolutely free from moisture before a perfect adhesive deposit of smoke can be obtained. The most convenient and generally adopted method of smoking the mold is best accomplished with an ordinary kerosene torch. The mold held over the torch for a few seconds will receive a deposit of smoke. This deposit should be perfectly uniform, but not necessarily heavy if a first-class casting is desired. The molds are next set up in their proper position for the operator to proceed. Considerable care must be exercised in starting the mold as the smoked surface of the mold is very sensitive and very easily destroyed. The operator draws with a small hand ladle a sufficient amount of metal from his pot of hot metal to fill the mold. Before pouring the hot metal into the mold, it is particularly necessary to chill the ladle of hot metal;

the object in cooling the metal is to set the smoked surface; should the hot metal be poured into the mold the smoked surface would be destroyed—then the operator would have to resort to the smoking operation again. It is possible to operate some molds without smoking, depending entirely on the design of the mold. Cold water poured in some molds has a tendency to form a water scale which enables the operator to produce satisfactory results. One of the principal features in connection with casting this alloy is to keep the heat of the mold below a certain temperature. If the mold should get too hot, it will be impossible to produce a satisfactory casting, as the metal will not set or harden. All that is required to regulate the temperature of the mold is a pail of cold water and by using a swab dipped in cold water. Some molds, if not properly smoked, have a tendency to burn the castings in spots. A little cold water applied to the exterior of the mold on these spots will suffice to remedy this. The castings are next transported to the trimming and inspection room. Here the gates are broken off, properly trimmed, all imperfect and inferior castings are returned to the melting pots to be re-casted. The castings are next counted out in suitable quantities and delivered to the polishing department. Here the castings are cut down on a cloth wheel with white diamond or some other cutting compound. They are next colored up with crocus and a sheepskin wheel. This mode of polishing is all that is required, as a very satisfactory color can be obtained. Very little of this alloy is sand-buffed to-day, although a few years ago it was generally customary to sand-buff all of this class of goods. The castings are now shaded with tissue paper. All work that contains any polishing compound or are not properly cut down are returned to the polisher that did the work, as each man's work is kept separate, and when a job is rejected there can be no cause for argument.

The polished castings are now delivered to the plating room in dozen or gross lots depending on the net quantities. The work is racked upon suitable racks, some racks holding six pieces and others as high as one hundred, depending entirely on the size and design. The racks are made of iron and can be used for an indefinite length of time. When a heavy deposit has formed they must be stripped off. The work is now suspended in the potash.

* There is a great diversion of opinion in regards to the cleaning of this metal. I am taking the liberty to state that I have tried a number of cleaners and would-be cleaners, but considering the amount of metal and the value of the alloy, it leaves me satisfactorily convinced that the common 3X Soda and Lye gives me the best results. My method of working and maintaining the potash bath is to dissolve a quantity of potash in warm water, not boiling, bringing up solution to stand about 20 Deg. B.; then draw off enough regular potash, enough to stand about 60 B. In doing this, it is necessary to be careful so as not to disturb the sediment. Therefore you have a perfect, clean potash bath. The potash kettles that I am using

have a capacity from 8 to 16 racks. The racks are put in and taken out of the pot consecutively.

The work is suspended in the cleaner a few minutes. They are then properly rinsed, brushed with a soft brush and hung in the nickel bath. The nickel baths are one hundred gallons copper.

My experience with this alloy, day after day, has given me the opportunity to learn that the double nickel solution gives me all that is required with the ordinary addition of conducting salts, etc. The nickel baths are fitted up exactly the same throughout with same amount of anode surface, 5 Deg. Be. with $2\frac{1}{2}$ - $2\frac{3}{4}$ volts pressure. Therefore, by using these baths as near uniform as possible I believe a plater can maintain his solutions in better condition and the net results will be far greater.

As this class of work is not nickel buffed, it is not necessary to give a heavy nickel deposit, although heavy enough, and at the same time, bright enough, to assure a good deposit for the next plating, silver. The silver solutions that I am at present using are all fitted up with iron cathode bar and under surface anode bar and are capable of handling same amount of work as the nickel bath.

I think it is a universal fact that in order to obtain satisfactory results in silver plating, all work must be struck up in a silver strike. My method of producing large quantities of silver plated goods is to keep all the tubs filled to their greatest capacity at all times. Proceeding with the silver plating two — are taken from the nickel bath, properly rinsed and hung in the silver strike after the work is properly struck, which requires a minute or so, depending on the cathode surface. They are moved along, hung in silver solution No. 1 until the next two racks are ready to be taken out of the strike, and so on until both silver baths are filled up. This requires from 5 to 15 minutes, depending entirely on the article and finish desired. From actual experience with the alloy, I find that running the silver strike at 5 deg. Be. with from 3-4 volts and silver baths 6 deg. Be to 7 deg. Be with $2\frac{1}{2}$ -3 volts and the correct metallic contents, will give all that is required in a pure white deposit. A great percentage of casket hardware is put on the market in the bright silver finish and must necessarily be silver buffed in order that the silver buffers may handle the work without a great deal of cutting down. The plating is supposed to be turned out of plating rooms as bright as possible, therefore some brightening agent must be used, such as Carbon Bisulphide or Benzole, but consensus of opinion greatly favors the carbon brightener. As little as possible of this should be used, as it is very powerful; a little in excess will cause no immediate harm or damage, but if too great an amount should be added, it will cause considerable trouble to plater and it will be impossible to produce a bright finish.

Extreme care must be exercised when using carbon for a brightener. I might also mention that it is not necessary to agitate all of the work in the silver baths in order to produce a bright

plating, but increasing the power and agitating the work for instance, the racks that are ready to come out of silver bath are moved very briskly back and forth for a few moments will give a much brighter surface than if the power had been left at regular point and work not agitated.

After the work has been sufficiently plated they are rinsed in silver rinse, then in perfectly clear cold water, then in hot water from four to five minutes. The work is then swung off and placed in steam heaters for fifteen minutes.

*Chicago Branch.

Determination of Free Cyanide in Cyanide Copper and Brass Baths

J. T. BURT-GERRANS AND G. O. MORRISON.

IT is well known to all platers that, after being used for some time, brass baths and alkaline copper baths frequently require the addition of fresh potassium cyanide to keep them in working order. If the amount of the addition is not to be determined by mere guess work, some analytical method of determining the cyanide in the bath must be adopted. Many such have been proposed.

For the determination of the content of cyanide in a pure solution of an alkaline cyanide (such as potassium or sodium cyanide) Liebig¹ used a standard solution of silver nitrate and measured the volume required to produce a permanent precipitate in a known volume of the solution to be analyzed (Method I). To make the end point more distinct he later proposed the addition of a little common salt as an indicator (Method II). J. S. McArthur and J. E. Clennell² substituted potassium iodide for the common salt (Method III). Carl Mohr³ employed an ammoniacal copper sulphate solution of known composition instead of the silver nitrate, adding it to a measured volume of the solution to be analyzed until the purple color ceased to be discharged (Method IV). In a recent number of the *Brass World*, E. S. Sperry⁴ proposed the use of a neutral solution of zinc nitrate as a standard solution, adding it until a permanent precipitate was formed (Method V).

All these methods give satisfactory results when the solution to be analyzed contains only potassium cyanide and water. If copper

¹ Liebig *Anal. der Chem. u Pharm.*, 77, 102; Fresenius *Quant. Chem. Analys.*, I, p. 549.

² J. E. Clennell. *Chemistry of the Cyanides*, p. 8.

³ F. Mohr *Titrimethode*, p. 421.

⁴ *Brass World*, May, 1913.

or zinc salts be present, the amount of cyanide found by the analysis is less than the amount of potassium cyanide taken in making up the solution for analysis; hence a distinction has arisen between "free" cyanide, as found by analysis, and "combined" cyanide united with zinc or copper to form complex salts.

For the determination of free cyanide in copper and brass baths, Langbein⁵ describes Method II, but recommends that "only about 60% of the discrepancy of free potassium cyanide" (as determined by Method II) "should be replaced by pure potassium cyanide"; and states that "analytical method alone is not sufficient for maintaining entirely constant baths containing potassium cyanide; and practical experience and a good faculty of observation are required if the results of analyses are to be used for the correction of the baths."

To a chemist, the conclusion to be drawn from this frank statement seems to be that the analytical methods needs improvement, since the only object in making the analysis is to obtain exact data for correcting the bath. As it seemed, moreover, for a chemical reason, very likely that the methods I to V would not give accurate or concordant results in cyanide solutions containing ammonia, alkaline, bisulphites and the other salts commonly met with in copper and brass baths, a number of experiments were undertaken with a pure solution of potassium cyanide containing no copper or zinc. A measured volume of this solution was taken in each case and the cyanide determined by each of the five methods mentioned above, but before making the analysis a measured amount of some common alkali or salt was added to the cyanide solution.

The results of the experiments are given in tabular form. Column one gives the name of the salt or alkali added, column two the amount used expressed in⁶ grams per 100 cc of the potassium cyanide solution taken for analysis.

The numbers in the other columns give the number of grams of potassium cyanide in 100 cc of the potassium cyanide solution as found by the five methods of analysis used. The amount of potassium cyanide actually present in the solution was in every case exactly 1.00 grams per 100 cc (1 lb. per 10 imperial gallons). Examination of the table shows that all five methods give the true value, viz., 1.00, when nothing but potassium cyanide is present in the solution; but that anywhere from 3.7 to 0.9 grams of potassium cyanide per 100 cc were "found" by the different analytical methods when alkalis or salts were present. Now alkalis and salts are generally, if not always, present in commercial baths.

⁵ Langbein, *Electro Deposition of Metals*, p. 336.

⁶ One gram per 100 cc is the same as 1 lb. av. per 10 imperial gallons (12.01 U. S. gallons).

Substance Added		Silver Nitrate			Zinc Nitrate	Ammonia- cal Copper Sulphate
Name	g. per 100 cc of Pot. cyan. sol.	I	II	III	IV	V
None	0.0	1.00	1.00	1.00	1.00	1.00
Potassium hydrate.....	*	1.01	1.01	1.00	2.71	0.98
Potassium carbonate.....	2.0	1.00	1.00	1.00	1.58	0.98
Potassium carbonate.....	4.0	1.00	1.00	1.00	1.75	0.91
Ammonia Sol. (Spl. gr.)=0.90	3.6	1.11	1.12	1.00	2.56	0.98
Ammonia Sol. (Spl. gr.)=0.90	7.2	1.31	1.28	1.00	3.72	0.98
Sodium thiosulphate.....	2.0	1.59	1.59	1.10	1.07	1.06
Sodium thiosulphate.....	4.0	2.35	2.35	1.18	1.45	1.14
Sodium bisulphite.....	0.4	0.99	1.00	0.95	0.72	1.15
Sodium carbonate.....	2.0	1.00	1.00	1.00	1.62	0.97
Sodium sulphate.....	2.0	1.00	1.00	1.00	1.06	1.00
Sodium acetate.....	2.0	1.01	1.01	1.00	1.08	0.97
Sodium chloride.....	2.0	1.00	1.00	0.99	1.02	0.99
Sodium phosphate.....	2.0	1.02	1.02	1.00	1.12	1.00
Rochelle salts.....	2.0	1.00	1.00	1.00	1.39	0.99
Sodium bisulphite.....	0.4 } 2.0 } 0.4 } 0.4 }	1.00	1.00	0.99	1.60	1.08
Sodium carbonate.....	0.4 }	1.03	1.02	1.00	1.25	1.21
Sodium bisulphite.....	0.4 }					
Sodium carbonate.....	0.4 }					
Ammonium nitrate.....	2.0	0.98	0.98	0.98	1.00	0.93
Ammonium chloride.....	2.0	0.97	0.96	0.98	0.97	0.91
Ammonium carbonate.....	2.0	0.97	0.96	0.97	1.28	0.89
Ammonium oxalate.....	1.0	0.99	1.00	0.99	1.02	0.96
Arsenious acid.....	0.1	1.00	1.00	1.00	1.03	1.00
Potassium Ferro. cyanide.....	2.0	1.09	1.09	1.00	1.01	br. ppte.
Amm. sulpho cyanate.....	2.0	1.00	1.00	0.99	1.04	0.92

* Concentration not known.

Comparison of the five methods shows that number III, using silver nitrate and potassium iodide, is the most reliable; results obtained by this method come within a few per cent. of the truth in every case except when sodium thiosulphate ("hypo") is present; after hypo, ammonium salts interfere most, but free ammonia, alkalis, carbonates, bisulphates and the other salts do not hurt. Detailed instructions for the employment of this method are therefore appended.

A number of experiments have been carried out by the writers in conjunction with the members of this society in the laboratory of the Toronto branch, in the Central Technical School here, with a view to adapting this method to the determination of free cyanide and of zinc in brass baths. The results have been most encouraging and have enabled us to bring several brass baths which would not place into a condition which gave very good deposits. When the investigation is completed we hope to be able to report *details of the determination of free cyanide by the use of silver nitrate and potassium iodide as indicated.*

THE APPARATUS NEEDED.

The apparatus necessary is simple, all that is required being a one-litre measuring flask, two 50cc burettes, a 10cc measuring cylinder, a 10cc pipette, a balance sensitive to one milligram with 15 grams load and a few 300cc beakers. The end-points of the titrations are sharp and distinct (in contrast to those of the zinc nitrate and ammoniacal copper methods) and with a little practice duplicate determinations of free cyanide may be made in 20 minutes or half an hour.

SOLUTIONS USED IN THE ANALYSIS.

Solution of Silver Nitrate—Made by dissolving 13.037 grams of crystallized silver nitrate in distilled water in the litre flask, and making the volume up to one litre with distilled water. This is the standard solution and must be made up carefully. The crystals must be weighed accurately, distilled water used, the volume made up to exactly one litre and the whole well mixed by shaking. When properly made it is perfectly clear and colorless; it should be kept in a glass stoppered bottle.

Solution of Potassium Iodide—Made by dissolving 10 grams of potassium iodide in enough water to make one litre.

Solution of Sodium Hydrate—Made by dissolving 200 grams of stick caustic soda in enough water to make one litre.

Solution of Hydrochloric Acid—Made by diluting 10cc of pure concentrated hydrochloric acid of specific gravity 1.12 to one litre.

Solution of Potassium Ferrocyanide—Made by dissolving 37 grams of the crystallized salt in enough water to make one litre.

Solution of Phenol-Phthalein—Made by dissolving one gram in 100cc of pure alcohol and adding 100cc of water.

None of these solutions, except the silver nitrate solution, need be made up with extreme accuracy.

DETERMINATION OF FREE CYANIDE IN CYANIDE COPPER BATHS.

In the case of a cyanide copper bath, known not to contain zinc, the procedure is as follows: By means of the pipette measure 10cc of the bath into a beaker, add about 5cc of the potassium iodide solution; then add the standard silver nitrate solution from a burette until one drop causes the appearance of a yellowish milkishness which does not disappear on stirring. The number of cc of silver nitrate solution used, divided by 10, gives the number of grams of free cyanide in 100cc of the bath, that is, the number of pounds of free cyanide in 10 imperial gallons (12.01 U. S. gallons) of the bath.

DETERMINATION OF FREE CYANIDE IN BRASS BATHS.

When zinc is present, as in brass baths, the analysis must be carried out in three steps:

Step I.—Pipette 10cc of the bath into a beaker; add 5cc of the

potassium iodide solution and 5cc of the sodium hydrate solution; then add silver nitrate solution, from the burette, until one drop gives the permanent yellowish turbidity.

Step II.—Another portion of 10cc of the bath is pipetted into a beaker and one or two cc of the potassium ferrocyanide solution added. Slightly more than the amount of silver nitrate solution needed in Step I is added at once from the burette. A few drops of the phenol-phthalein solution are then added, which causes the milky liquid to turn pink. Now, without filtering, the hydrochloric acid solution is added from a burette until the pink color just disappears; this step shows how much acid is needed to make the bath neutral.

Step III.—A third 10cc portion of the bath is pipetted into a beaker and the same amount of hydrochloric acid as was used in Step II is gradually added from the burette with stirring. About 5cc of the potassium iodide solution is poured in from the measuring cylinder or added from a pipette, and then the standard silver nitrate solution from its burette, until the milkiness appears and remains permanent after stirring and allowing to stand for half a minute. The number of cc of silver nitrate solution divided by 10 gives the number of pounds of free cyanide in 10 imperial gallons (12.01 U. S. gallons) of the bath.

Example.—Suppose that in Step III 12.5cc of silver nitrate solution were used, then there are $12.5/10=1.25$ lbs. of free cyanide in 10 imperial gallons (12.01 U. S. gallons) of the bath.

NOTES.

If, on the addition of silver nitrate in Step I, a black or gray precipitate appears before the yellowish turbidity, the analysis must be begun over again with a fresh portion of the bath and less caustic soda and more potassium iodide must be used. So far we have observed this black precipitate only in brass baths which were known to contain sodium bisulphite and arsenic.

If the bath is neutral to litmus paper (this will not occur with old baths) Steps I and II may be omitted, and the analysis begun at Step III; it is safer, however, to go through the whole procedure.

In conclusion we wish to express our thanks to Dr. W. Lash Miller for the useful suggestions in the carrying out of this investigation and for editing this paper.

The foregoing investigations were conducted by the members of the Toronto Branch and were written up and formed by Messrs. J. T. Burt-Gerrans and G. O. Morrison, of the Toronto University staff.

American Electro-platers' Society

(An Educational Society)



Chartered 1909

QUARTERLY REVIEW

DECEMBER-JANUARY-FEBRUARY

1913-1914

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QUARTERLY REVIEW

American Electro-platers' Society

(An Educational Society)

Vol. I.

December-January-February, 1914

No. 3

Editorial

THE NEXT CONVENTION

MORE than a year has swiftly passed since the first convention of our Society, and the date of the second convention is drawing near. So near in fact that the convention should be a live topic at every meeting, and it is perhaps unnecessary to remind the members that it will be a very important event in the history of the Society.

Chicago Branch is awaiting in pleasant anticipation the visit of the representatives of its sister Branches, and is preparing to duplicate the royal welcome and beautiful hospitality that the Mother Branch extended to the delegates to New York last year.

It is time for the Branches to elect their delegates and to instruct them as to their wishes in any of the matters that the Branches are interested in having brought before the convention. There will no doubt be some suggestions for changes in our present laws, and many new ideas for new laws will be advanced. More delegates will be present than were at the last convention, and more opinions will be expressed, and as our present laws have been tried for a year or more, we now know how suitable they are for our needs and if any weak points have been noticed, the experience of the past year will tell us how to strengthen them.

The importance of being represented by one or more delegates can not be too strongly impressed on the Branch Societies. It is the only chance that the membership has to meet and discuss the many things that come up in the course of a year in a society that has grown as rapidly as ours has. To give the Society a good start for another year of prosperity and progress will be one of the chief

duties of the convention, and this alone should be incentive enough for every member in every Branch to boost the convention and insist that his Branch be represented and represented strong.

It is time now that the Branches that may have new laws to suggest, or amendments to existing laws to offer, to get busy on their ideas and put them in such shape that they may go before the convention in proper form. And send them along with a delegate who can put up a good argument, for there is nothing that will stir up interest like a good argument, and interest at meetings and conventions means interest in our Society, and interest in our Society means progress.

There is little use to point out the benefits that we have enjoyed because of our membership. If the Society had done nothing else, it has added dignity to our profession, and brought to the attention of the employer the plater and the plater's problems, and those two things alone are worth every effort made and every penny spent to promote the Society. It has not only made us better platers, but also better men, for it has made us friends, with a friendly feeling for each other, and who can say that any movement that promotes friendship does not add to the sum total of human happiness, and anything that promotes happiness makes men better.

So, brother plater, get busy and see to it that your branch is represented in the convention. Boost and then boost some more. Your officers are doing their best, and, being your servants, will go as far as you want them to. So send your delegates to the convention to tell what you want your officers to do for another year. And come yourself. You'll enjoy it and profit by it, and until we all meet in Chicago BOOST THE CONVENTION.

J. H. H.

St. Louis Banquet, January 24th, 1914

ST. LOUIS branch, A. E. S., held their first banquet at the American Annex on Saturday, January 24th.

Eighty-one (81) members and their employers were present; it being one of the objects to enlighten the manufacturers on the real work and show them (as we are from Missouri) that the benefits received are mutual.

The hustling ability of E. J. Musick, chairman of committee, was shown by the attendance, and after an excellent dinner served in the magnificent banquet room of this new hotel, he introduced H. H. Williams, secretary and treasurer of St. Louis branch, as toastmaster. Mr. Williams in a few words extended a welcome to all and stated a few facts concerning St. Louis branch, as follows: That on December 5th, 1912, it started with nine members and a month later with nineteen members applied for a charter, and at present has twenty-six members in good standing. He also told of the work it was doing and the results.

Mr. E. Lamoureux, of Chicago branch, was introduced as the father of the branch, he having been instrumental in starting it off. Mr. Lamoureux read a paper on "Efficiency: Technical and Business Ideas on Electro-Plating."

"The Past, Present and Future of Electro-Plating" was the subject of a paper read by H. J. Richards, of St. Louis branch. Mr. Richards had a good story to illustrate every point.

"The American Electro-Platers' Society" was the subject of an address by our Supreme Vice-President, J. H. Hansjosten, of Kokomo, and special mention was made of this excellent and able address.

Mr. F. J. Liscomb, of Chicago, read a paper on "Nickel Solution Investigations," which was the result of experiments as to metallic content and other conditions.

One of the pleasant surprises on this occasion was to have present with us the founder of the society, Mr. C. H. Proctor (who also represented our Supreme President, Mr. George Hogaboom). In his address Mr. Proctor congratulated our branch; told of the societies' activities and predicted a bright future for all.

Mr. Oscar E. Servis, secretary and treasurer of Chicago branch, brought greetings from his branch and made an address on "Mysteries of the Past and Co-operation of the Present."

Impromptu remarks were made by the following manufacturers: Mr. C. Phillips, of Landay Stove and Range Company; Mr. F. R. Henry, Majestic Manufacturing Company; Mr. W. F. Koken, Koken Barber Supply Company; Mr. G. Hammon, of Quick Meal Stove Company; Mr. H. C. Hoener, of Bridge & Beach Manufacturing Company; Mr. W. H. Musick, Musick's Plating Works;

also by H. H. Van Horn, H. C. Starrett, of Chicago, and O. Halmbacher, of Decatur, Ill.

Congratulations on the success of the affair were many, and a brighter future predicted for our work.

The following committee was in charge: E. J. Musick, J. T. McCarthy, H. J. Richards, R. O. Bosch and H. H. Williams.

Address by Mr. Chas. H. Proctor

Mr. President, Members and Guests of the St. Louis Branch of the American Electro-Platers' Society:

I can assure you that I feel extremely grateful to have the pleasure of being one of your guests on this auspicious occasion, the first annual banquet of the St. Louis branch. As I have traveled across a portion of the United States to the extreme outpost of our society in St. Louis, the thought comes to me that perhaps in another year or so I may have the opportunity of being present at a banquet in far-away San Francisco, and then our society will extend from the Atlantic to the Pacific Ocean as well as Canada on the north, even as to-day our membership extends across the broad expanse of our mighty land between these great oceans.

To you gentlemen who have labored so incessantly to create the St. Louis branch for the benefit of the craft in your city and near vicinity and for the culmination of your successful efforts to make this evening a milestone in your future development, I extend to you my personal thanks as the founder of the American Electro-Platers' Society. I also extend to you on behalf of the Supreme President, Mr. George B. Hogaboom, whom I have the honor to personally represent, his felicitations for your continued progress and prosperity with hopes for the future that the work you have started out to accomplish may bear fruit beyond fondest dreams.

Looking backwards through memory, that mental diary of the human race, I can scarcely realize that a third of a century has elapsed since I was last in your beautiful city. Many changes must have taken place since that time; modern development must have progressed here as in other mighty cities of our country, and to realize that you, as members of the American Electro-Platers' Society in becoming its votaries, have become a part of that modern development in unity of purpose. Not only for the welfare of the interests of the electro deposition of metals in your city, but in that modern development of our commercial welfare that must constantly be maintained to keep our country in the foremost ranks of the great commercial nations and to maintain American labor upon the highest pinnacle among the workingmen of the world.

In those years of long ago when in your city as a boy, I was a wanderer without a friend and with very little finances in my pocket, "a stranger in a strange land," and as I remember I stood

upon the bridge that spans the mighty Mississippi and dreamed of the future. I looked towards the golden west with its beautiful setting sun, and as I looked again down the river no thought came to me that my next visit would be after the lapse of so many years and then to come among friends and to realize that wherever my footsteps might wander throughout this great country, wherever there was a plating tank in operation I could find a friend.

The American Electro-Platers' Society has made a wonderful advancement in the few years of its history. To realize that it consists, besides the Supreme Society, of thirteen branch societies in most of the largest commercial cities of this country is almost beyond comprehension. No society of a like nature has ever accomplished so much in so short a period, and its progress in the future will, I am sure, be maintained by the continued interest of its members that is constantly displayed by the application of its precepts that are carried out in practice.

To say that you are a member of the American Electro-Platers' Society gives a dignity to your profession which I am sure in the years past was sadly neglected. You know the old saying is that "dignity adds to dignity," so the future welfare of the American Electro-Platers' Society depends upon what you can add to it as members or in the words of the immortal Longfellow:

"Be up and doing, with a heart for any fate,

Still achieving, still pursuing, learn to labor and to wait."

In your regular meetings get up and say something, start some sort of discussion, tell of your little troubles and your pet schemes, and tell it in your own way. There is nothing so interesting as discussions to benefit the plater. Those latent powers that you possess through years of persistency in your profession will come to the surface and you will then realize that you can make a name for yourselves that will not only be a benefit to your branch, but also to the membership at large.

I wish to add my personal felicitations for your future welfare and trust that you will work unceasingly so that the St. Louis branch may become one of the banner branches of the society.

All true work is sacred; in all true work, were it but true hand labor, there is something of divineness.—*Carlyle*.

Efficiency, Technical and Business Ideas on Electro-plating

E. LAMOUREUX,

Member Chicago Branch's Board of Managers, with Manning
Loeb & Co.

IN responding to the request to read a paper at this meeting, I have taken into consideration the fact that it is really very difficult to write upon any phase of our craft and submit anything absolutely new, and while the title of this paper indicates a good deal, I trust your expectations are not too high, because I do not expect to do else but touch briefly on certain points which may be of benefit to us all.

Speaking from the business side of our society, I have wondered whether or not platers realize fully the advantages to be derived from membership, and also whether or not you, Mr. Employer, fully appreciate these advantages. Taking the active and associate membership, as well as the employer of platers, as we are assembled here, it would not require much thought to recall the experiences of well-meaning and ambitious platers, who were more or less lacking in the required knowledge and general ability to manage a department in the proper manner. With the advent of this society, the exchange of knowledge began, and with the establishment of bureaus of information, the standard and efficiency of the membership has been enhanced to a point where its value would be difficult to estimate. This, as well as the fact that the society also maintains an employment bureau, are reasons why every employer of platers should be a staunch supporter of the society. With the advantages gained from the increased standard, and the society working towards standard methods, we have a condition where a change of platers' foreman will not necessarily mean the dismantling of the plant to suit the ideas of the new foreman, and where it will eventually be possible for the new foreman to step into the place of his predecessor, and have everything move on as though no change had taken place. The society has already done more towards bringing the plater foreman and his employer together than all previous efforts. While this has been going on the associate members have assisted toward the success of the movement, and, while there has been comment and criticism on the part of some that the active and associate membership were getting too close together, I want to go on record in stating that nothing, to my knowledge, was ever so far removed from the facts. The plater foreman to-day is further removed from these influences than ever before, and there never was a time in this field when both he and his employer have been more independent. If we will take advantage of the means at hand, the concerted efforts of all three can maintain conditions that will hold the unscrupulous from our ranks, and result in efficiency for all, where a condition of chaos formerly held sway to a large extent.

In reference to the words, "efficiency" and "technical," these words cover a wide field, and it is not my intention to enter into a lengthy discourse upon either. I desire only to touch upon the technical and efficiency side of a particular branch, i. e., Nickel Plating.

We have read much in recent months regarding high-grade nickel salts under various captions and names, and we may grant that all of them have merit from a working standpoint, but absolutely no merit from a price standpoint, because the results claimed can be produced by ordinary methods as will be shown.

In the last two years many plants doing nickel plating have been gradually turning to the use of the single-salt solution, gradually abandoning the double-salt solution. This single-salt solution consists of 24 oz. single nickel salts, 5 oz. boracic acid and $1\frac{1}{2}$ oz. sodium chloride, and will stand at about 13 degrees Beaume. While this solution will give excellent results with 90/92% anodes, it has been found that much better results can be obtained by using anodes of 95/97% purity. The advantage can be noted at once, both from an efficiency and buying standpoint.

In a recent paper read before a branch of this society the statement was made that deposits from double-salt solutions have been found which analyzed as high as 15% iron. This would be due both to the fact that a 90/92% anode contains about 6% iron, and that the solution will take up iron from the work providing pieces which had dropped to the bottom of the tank have been allowed to remain there. While the single-salt solution would take up iron also from parts allowed to remain in it, we have much less than 5% iron to start with.

One of the theories advanced against this solution is that the deposits have a tendency to be of a warty character. A study of actual practice on several kinds of work, composed of brass, steel and iron does not show any such results, unless the deposit is carried beyond the ordinary thickness. I refer here to actual practice where a large volume of work has been turned out constantly every day for two years.

There is a difference of opinion as to the method of operating this solution, and I may state here that the study referred to above has been of solutions made up exactly according to the formula herein submitted, but some parties claim better results by having the solution about four-tenths alkaline to sulphuric acid. This is done by using enough carbonate of nickel to take up the free sulphuric acid; the carbonate should be added until red Congo paper no longer shows any discoloration; this has been found to give a condition near enough to four-tenths alkaline for all practical purposes, and at this point there is no free sulphuric acid, but the boracic acid is free to act. The following important points about this solution may be considered: To date no case of pitting has ever been brought to my attention, and if used with the high-grade anodes there is practically no sediment, resulting in a much cleaner tank

condition, and even at 13 degrees Beume there is practically no crystallization around the anodes or sides of the tanks. If we take nitric acid of 1.18 specific gravity and put a drop of this acid at the weakest point of a 19-minute deposit with a current density of 9 amperes per square foot, it will withstand the action of this acid 6 minutes, whereas it has been found that the same objects plated in the regular standard double-salts solution with a current density of $4\frac{1}{2}$ amperes per square foot, a deposit of two hours' duration would not withstand the action of this same acid more than three minutes. Another specific instance, on the efficiency of output per day, may be stated by taking an every-day workshop condition and following up results on 20 square feet of surface to be plated. In this particular plant all tanks are connected with separate ammeter shunts with proper lead wires, through conduits, to a switchboard, upon which is an ammeter of three hundred ampere capacity. By turning a switch to any tank by number we get the separate reading of the amperes flowing in that particular tank which permits of positive as well as very accurate results. The usual amperes per square foot for nickel, as you know, is four, and taking 75 ampere at $2\frac{3}{4}$ volts pressure in a double-salts solution standing $7\frac{1}{2}$ degrees Beume, and a single-salts solution at 13 degrees Beume, it was found that each batch of work in the single-salts solution tank could be taken out in 35 minutes, whereas that in the double-salts solution tank could not be taken out in less than one hour, and stand the buffing and wear to which this particular work must be subjected. By raising the amperes to 110, or an average of about 5.5 amperes per square foot, and $3\frac{1}{2}$ volts pressure, we could increase the output of the single-salts tank or the density of the deposit, whereas the work in the double-salts solution tank would burn to a point where it was very difficult to buff. Analysis of the deposit shows that of the single-salts solution with 95/97% anodes to contain .27 of 1% iron, while the deposit from the double-salts solution with 90/92% anodes showed 4.74% iron.

While the initial cost of this method of plating is higher than the other, all the users claim a lower maintenance cost per year, as well as a saving in buffs; in some cases as high as 50% and a consequent saving also in composition.

We all know that mechanical plating barrels are coming more into use as we progress, and some of them in certain instances may not have given the best results. The reasons for failure may not have been distinctly known, and a case in point may be stated. We all know, of course, that a solution for barrel work should be higher in metal than for still tank work. The formula of the single-salts solution for barrel work is 42 oz. of single salts, 5 oz. boracic acid and 4 oz. sodium chloride. In this instance the solution had been used for some time, and a point had been reached where all the work was being rejected on account of insufficient deposits and all ordinary tests showed the solution to be correct, the hydrometer test showed 13 degrees Beume and yet when a chemical test was made

it was found that the solution needed 80 pounds of salts to bring it up to standard, and the tank only held about 100 gallons of solution. The number of days the solution should be left in operation can be varied by the amount of work done in continuous operation. In small plants where plating barrels may be idle a part of the time this condition would not be so marked.

The description of the deficiency in metal of the solution as stated above shows that the hydrometer method of testing solutions as now used is not correct, and it also shows that a laboratory containing the essentials to make chemical tests is becoming a necessary adjunct to a plating room. The time is not far distant when all members of this society should be equipped to make these tests.

In the matter of efficiency three elements may be considered, the man, the equipment and the material; if either of these are lacking we do not get the most efficient results. I believe I can safely say that this society will continue to be the leading factor in raising the standard of all three.

Technically speaking very few plating plants have been installed along proper lines, or lines that will give the most efficient results, and each year more progress is being made in this direction. As we progress, engineers are becoming more interested in this work, and the time is not far distant when all plants will be installed along lines which are technically correct. Then the plater will not only know exactly what amount of energy he is using, or what amount of metal he is depositing, but will also be enabled to know the exact condition of his solution—all of these things combining towards better plating-room results and higher efficiencies.

In a great number of instances plating rooms are not properly wired as, owing to fancied economy, the leads and buss-bars from the generator are too small, contacts are not good and the branch wiring is either too small or imperfectly done.

Right along this line I wish to give an example on some recent installation work where a 3,200 ampere machine was involved. The extreme distance from the generator to the end of the tank row was 67.5 feet, and the distance from generator to the center of load 49.5 feet. According to the tables of carrying capacity three square inches of copper might be used in each bussbar, but, taking the ohmic resistance per 100 feet, the loss would have been 0.89 volts or 2,850 watts, or 14.85% of the generator rating. By assuming the value of one kilowatt hour of law voltage at 5 cents, including the losses in motor and generator, this loss would amount to \$1.14 per day of eight hours, or \$342.00 per year. If we doubled the cross-section of copper and used six square inches the extra weight of copper required would be 1,555 pounds, which, at 20 cents per pound, would cost \$311.00. By charging interest at 6% the extra cost upon the investment per year would be \$18.66, as against a saving per year in current of \$171.00, or a net saving of \$152.00. In two years this saving would very nearly pay for the extra copper used.

It will be seen by the above that the use of plenty of copper results in a saving of money.

The above is based upon the full ampere capacity of the machine and while the full capacity of any machine is not always used, the conditions can be taken as they are, and the results would be the same in relative proportions. I might state that in the installation referred to above four strips of copper 4" x 1/4" were used in each bussbar.

In this connection the rheostat condition is to be considered. It is evident that there is no point in saving losses in the bussbars and then causing a big loss in the tank rheostats. The proper way is to use plenty of copper in the busses and reduce the voltage of the generator to a point just high enough to do the work, as every volt drop at 3,000 amperes means 3.0 kilowatts lost.

In the foregoing it has been my aim to convey some idea of methods by which, from both the technical and practical viewpoint, the efficiency of plating departments may be considered, and if I have succeeded I shall feel amply repaid for my efforts.

The Past, Present and Future of Electro-plating

H. J. RICHARDS,

Foreman Plating Department of the Koken Barber Supply Company,
St. Louis, Mo.

Mr. Chairman and Gentlemen:

When I heard the subject on which I am to speak to-night, I certainly felt honored. "The Past, Present and Future of Electro-Plating."

The committee not only think I know about the past and present of electro-plating, but they believe I know what is going to happen in the future. I am first to tell you what I used to know, then what I know and then what nobody knows.

Mark Twain once went to have his fortune told and they asked him what he would have, past, present or future. He said, "Well, you can't make me any more ashamed of the past than I am already, and I know the present—give me the future." But in electro-plating we don't feel at all ashamed of the past. A small room completely lined with shelves filled with primary batteries, furnished the plating current in the first shop I worked in, and one of my first jobs was caring for those batteries. We were plating only gold and silver and doing very good work which sold at a high price. I don't wish to throw any consternation into the ranks of these dynamo sellers, but I could demonstrate to any silver plater that fine work can be done with batteries, that is, where time and expense and trouble and profits are no object. We made our silver and gold

solutions right from the metal, as nitrate of silver and chloride of gold were high-priced.

The first nickel anodes I saw were of granulated nickel in small fragments which had to be used in bags with a wire running through them. The only buffs we had was a loose, whole disc buff so high in price that buffs were often home-made. The muslin was cut into squares, which were folded twice, bringing the centre of the square on one corner, then the corner was snipped off and the square sections put on the buffing lathe and turned down.

The cyanide of thirty years ago was better than any supplied to-day.

The first dynamo I ever used was, if I remember rightly, an old Eddy machine—series wound. My recollections of that dynamo made me think of the man who had a trotting horse who was sued by Jay Wilkes and damned by everybody who handled him. The salesman who sold that machine made his escape quickly and I don't believe he ever did come back. The way that thing would get smoking hot in a few minutes was simply amazing. It took a fiendish delight in burning work in spite of any resistance, and then the next minute it would quit generating, having apparently gone absolutely crazy with the heat. The installation was all faulty and the speed fluctuated considerably, but we didn't know that had anything to do with it. Any explanations that we could get on the matter were very lame. They were as lame as the schoolboy's explanation in answer to the question as to what caused the ocean to be salty. He said, "Because of the millions of herrings which swim in it." But the way a dynamo would throw the metal was a revelation to one who had worked with batteries. Necessity soon compelled us to learn more about dynamos and the way to use them. We were like Bobby Gaylor, who offered to help a friend carry a stove upstairs. "You go first," he said. "I did. But when he lifted, the top of that stove came down on my legs." Well, I *had* to lift, and we *had* to learn. We soon got better dynamos.

Passing through the successive types, we are all familiar with the modern low voltage plating generator. I may say here that in my opinion the biggest factor in the progress of modern electroplating is the development and improvement of the plating dynamo. It is always, however, left to the plater to get the best use out of his dynamo and the current it generates.

The present great variety and assortment of all kinds of plating and polishing supplies brings to my mind the story of a new preacher in a negro church. On his first Sunday he was particularly impressive in his prayer; he prayed for everything that it was possible for a man to want. On the way home one of the congregation said to another, "Don't you think that was powerful prayer, Brother Johnson?" "Ah most certainly does. Why, that man asked the Lord for things that the other man didn't even know He had." And we are apt to find that the supply houses have things that we didn't even know they had.

One of the great achievements of modern plating is electro-galvanizing. In the early days of gold and silver plating we were competing with a very high-priced article, sterling silver and solid gold, but the electro-galvanizer is competing successfully with what always was the cheapest and best method of rust-proofing iron, galvanizing.

The narrow anode now always used is a great improvement and mechanical or barrel plating is undoubtedly one great step in the forward march of electro-plating. Small work can be turned out by this method at a very low cost. It also gave the supply man a nice opening through which he could soak the plater with a lot of high speed, high-priced nickel salts. Analysis of some of these seems to prove the truth of the old adage, "there is nothing new under the sun," because their ingredients are according to formulas that have been long known and used. But they keep on coming, and we are beginning to think that where there is so much smoke there must be some fire. The merit or lack of merit of these salts will have to be determined in the near future by the American Electro-Platers' Society. We want the *very best* methods in all our works—that is *all we want*. We don't intend to be like a condemned prisoner who was asked on the gallows before execution, "Have you got anything you wish to say?" and he answered, "Yes, sir; I like to say a few words. I just like to say that this will certainly be a lesson to me."

The future of electro-plating, I think, will be an ever-widening field of usefulness. One thing which assures the future of electro-plating is a trait of human nature which never changes, the well-known fact that no matter how useful an article may be, to be a seller it must be attractive in appearance. It may be good, but it must look good or it won't sell.

Electro-plated cobalt may compete with nickel in the future; it is abundant, at present little used. It can be plated with the double salts as is nickel, and it has the appearance of nickel. It may possess good qualities to the electro-plater that we are at present unfamiliar with. The enormous success of mechanical plating and electro-galvanizing and the ever-increasing price of tin leads me to predict that in the future it will be up to the electro-plater to supply a cheap, efficient food container, that the sheet iron foundation of the present tin can will probably be electro-plated. That in the future the right article to attach to the tail of a fugitive dog or an incompetent employee will not be a tin can, but an electro-plated container.

Address and Paper

FRED J. LISCOMB,
Hanson & Van Winkle Company.

Gentlemen and Guests of the St. Louis Branch:

Perhaps I had better apologize to you before I start for what I am about to inflict upon you. On the other hand, perhaps you had better demand that your president and secretary do the penance, for it is because of their demand that I have consented to harrangue you to-night.

One incident in my own career as a plater will further explain why I have obeyed their demand. It will also show the relation of the supply house salesman to the plater. For several years before I became a peddler I was in charge of a plating room in a part of the country out of the beaten track of the salesman of our line. There was one man whom you all know, however, who used to hit the trail once a year and my calendar was always marked "Starrett" on the date of March 4. This was a reminder that he would arrive on that day.

Besides being isolated, in those days there were no "Brass World" and "Metal Industry" to consult, so when Starrett came along he was backed up in a corner and told to "talk, damn you, talk," and it was through his talk that I was able to keep in touch with the outside plating world.

Now, I have made it a rule of my life not to ask anyone else to do a job that I would not do, and if anything that I can talk to you about ever does even one of you men one-tenth the good that Harry Starrett's talks did for me, then I am more than willing to work nights and Sundays to get something to talk to you about.

Mr. Williams, "the boss," in his letter told me to talk on nickel solution experiments. A good motto to have hung where you can see it at least in your mind's eye is "Mind the Boss."

SOME EXPERIMENTS WITH NICKEL SOLUTIONS

In the presence of so many able platers, who have long since ceased to be experimenters, I greatly fear that it will be a difficult matter to describe the workings of a nickel bath and at the same time say something that will be new, unless we go into the question from an angle other than how to get out the largest quantity of work in the shortest possible time and at the least cost of production.

To describe experiments and put the results down as positive facts is likewise difficult, because in trying to duplicate the results it is necessary to have all conditions exactly the same. By this, I mean the E. M. F., the current, the strength, the temperature and many other details which at first glance seem so small that they can be neglected; but if we should neglect them through oversight or ignorance it would be impossible to keep within the limit of error.

For several months I have been making a study of the resistance of all kinds of plating solutions and their metallic content, and the cause of pitting and spotting out on stove work, and I am surprised to find that many of the supposed remedies have a tendency to increase the defect rather than to relieve it.

When we find a nickel solution pitting we ask what we shall do to stop the unsightly pits from forming on work that is otherwise very satisfactory. The usual answer is, that the bath has become impoverished and lacks metal. An experiment along this line shows that out of forty-one nickel solutions examined, all of which have been used on stove work in the Middle West, six of the samples were marked "Pitting." A volumetric test of the nickel content showed that these six pitting solutions contained the most metal rather than the least. From this I am inclined to believe that many times pitting is caused by the solution being too dense. At the same time, if an alkaline condition prevails the bath becomes sluggish and the hydrogen gas does not rise freely, but adheres to the surface of the metal being plated and acts as an insulator, preventing the metal-laden solution from coming into contact with the work and depositing metal at this point.

From this it would seem that the remedy for this trouble would be to dilute and agitate the solution, or reduce the voltage, or, better yet, a combination of all three.

Many stove companies have trouble with some of their nickel-plated castings developing a white, featherlike mould over certain portions of the surface after the stoves have been stored away in the loft. The knowledge of this fault makes it necessary to unpack many stoves before they can be shipped. This causes extra work and oftentimes much delay.

To overcome this spotting out, many experiments have been tried; they are too numerous to describe here. Having been called upon several times to solve the problem, an investigation was begun which extended over a couple of years. The conclusion finally reached was that the castings that spotted out in this manner were very porous, due to faulty gating and being poured with iron when too hot. Most of these castings are large.

The custom in many shops is to plate all of the large work early in the day, so the large castings, being hard to clean, are placed in the alkali solution over night, with the probable result that the porous iron soaks up the alkali solution, and, owing to the depth of the imperfection of the castings, it is not removed with the cold rinse water and scrubbing operations. The cold dips without doubt cause the castings to contract to some extent and seal the alkali within.

The cleaning solutions are in the main composed of sodium salts, most of which when exposed to the atmosphere lose their water of crystallization and form a more or less flocculent powder, more bulky than the original salt. This forces them out of the pores of the casting and, being of a dull white color, they disfigure

the highly buffed surface, making it necessary to again buff the article.

In the several places where this was noticed, the practice of soaking the castings over night has been discontinued, with the happy result that the spotting out has ceased to worry these platers.

The nickel solutions of five stove companies, some of the largest in the Middle West, using in all about 12,000 amperes, have been examined as to metallic content, in the hopes of ascertaining if possible what metallic strength of solution gives the best results and what voltage and amperage produce the whitest and most satisfactory nickel deposit for stove work.

The metal content in four of the foundries averaged as follows:

- 1 4/10 oz. of nickel per gal.
- 1 5/10 " " " " "
- 1 6/10 " " " " "
- 1 7/10 " " " " "

While many of the solutions were as low as 1 28/100 oz. per gal., only one was found that reached 2 oz. of metal per gal.

Of the solutions examined, the one that gave the most beautiful deposit contained 1 3/10 oz. of metal per gal. and was worked at a scant two volts. At this voltage, with a temperature of 70° F., there was no difficulty in reaching the deepest background—there was no sign of burning or roughness, and the work buffed very easily. This solution was said to contain nothing but double salts. A 12 oz. double sulphate of nickel and ammonia solution contains at 70° F. from 1 75/100 to 1 78/100 oz. of nickel.

I fancy that all of these solutions when new contained at least 1 3/4 oz. of metal per gal., the greatest percentage of loss being due to the drip. This is usually made up by adding a certain amount of salts dissolved in water when you have time.

It has occurred to me that a good way to keep nearer on a line so far as the nickel content is concerned would be to have a tank or barrel in which a new solution is kept made up, and at the end of each day make up the loss due to drip from this tank, adding a small portion of single salts to make up that portion of metal lost by *insoluble* anodes. This latter amount can only be computed by actual experiment.

Judging from the presence of chlorine in these forty-one solutions, many of the stove platers believe in sal ammoniac as at least 50% of the forty-one contained chloride in varying proportions.

A word on the use of the hydrometer may not be out of place here. This instrument is of little value as a guide to tell how much nickel the bath contains except when making a new bath, for the reason that when several chemicals enter into the formula they all tend to increase the specific gravity and the hydrometer does not measure the density of any one ingredient but of the whole. In using the hydrometer the accepted method is to look across the surface of the solution and read the scale at the bottom of the meniscus and not the top as many operators do.

A good way to use the hydrometer is to take a drop of oil and rub it on the glass tube covering the scale. The solution will not crawl up the scale when oiled, but remains on a level with the surface of the solution. The difference between the top and bottom of the meniscus is about one degree. As the instruments are calibrated at the bottom of the meniscus this must be correct.

Several samples of solution came to hand that had been exposed to a very low temperature, probably below 32° F., as the bottles were full of slush ice, much salts had crystallized out, the hydrometer stood at 4½° B.—it originally measured 7° B.

The specific resistance of this solution was 120 ohms at 40° F. Heat was then applied until 70° F. was reached and the resistance again measured and found to be about 50 ohms. We can see from this that the temperature of the bath plays an important part in nickel plating. A fall of 30° F. makes an increase in resistance of about two and one-half times, reducing the conductivity in that proportion, so that a solution through which 150 amperes would flow at 70° F. at a given voltage would fall to about 65 amperes at 40° F., increasing the length of time necessary to deposit sufficient metal considerably.

In cold plating rooms the bath should be fitted with lead covered iron steam pipes and fitted with insulating unions to take the chill out of the solution on cold days.

It will be necessary to refer you to the article in the Review entitled "What Are Conducting Salts?" for the data on specific resistance mentioned above.

Mysteries of the Past and Co-operation of the Present

OSCAR E. SERVIS,
Secretary Chicago Branch.

*Mr. Toastmaster, Officers and Members and Guests of the St. Louis
Branch:*

It affords me great pleasure to be with you on this occasion, not alone for a personal reason, but because I know every member of the Chicago branch would be delighted to participate in your generous hospitality; and I want to assure the members of this branch that is is only due to the long distance between us that there are not more Chicago members here to-night, but their hearts are with you all.

Any attempt on my part to give you a speech is idle folly, but it was impressed upon me on the way down here that I would possibly be called upon to say something. Had I known this before starting it would have kept me at home. I will content myself by giving you a few remarks and recollections of a fellow plater. The past year has shown a remarkable growth in our society, and let us hope it

will not stop until every competent and worthy plater is within the fold. The spirit of progress that has been so manifest up to the present time must not cease. The A. E. S. must grow, and will grow by the efforts of each and every one of us; there is no surer way to success than by hard work and close application, so I wish to impress upon each and every one of you, not to let success turn to neglect. If we have had prosperity in the past year in our society, let us remember it is only a milestone to our goal, and that we must ever go onward with staunch efforts to brave the breakers ahead.

When I consider what has been accomplished during our short period of existence it makes me feel thankful that this society was founded on right principles, and that the founders were broad-minded men who were not afraid to cut through the forest of skepticism and egotism, which seemed to be a prevailing disease in our craft.

In the past year several of the branches have taken a keener interest in the work, by engaging able instructors in chemistry to lecture and demonstrate the rudiments of H_2 , SO_4 , and so on, which is a stepping stone to the greater knowledge which can only be obtained by personal study and instruction. Wonderful strides have been made in both chemistry and electricity in the last few years, and unless we work and labor along those lines with an effort to master the theoretic as well as the practical knowledge, we shall soon fall by the wayside.

Do not think if you have a "snap job" at the present that there is plenty of time to learn—you may some day be out in the cold. Peace is only maintained by strong defences. So do we wish to encourage all who are not yet members to join our ranks and aid in this great work of progress, which cannot but prove profitable to you and me and the coming generation.

So far it has been demonstrated that the plater is intelligent and willing to improve; also, that assimilation of knowledge and co-operation of efforts are essential to success. This we have already realized at our meetings. A few years ago you would have scoffed at the idea of a society of platers being possible. At that time the plater as a rule considered himself somewhat of a conjurer, and, shrouding himself in his cloak of mystery, he boldly asserted that no "bunch" was ever going to get him "hypnotized" and compel him to divulge that valuable secret in obtaining "that blue color," on brass, which "he" only knew, but, in fact, had been given to the world by the great pioneer, Roseleur, a generation ago, and is still in daily use. The speaker remembers when he was first initiated into the mysteries of electro-deposition of metals. The boss, after weeks of exhaustive experiments, one day succeeded in plating a coating of copper on a piece of steel, and your humble servant gazed on in wonderment at the result (thus achieved), and after having served his master well for many months, his thirst for knowledge became abnormal and he bravely asked the boss how this was done. That "worthy," with a sly wink, most

emphatically informed the "scrubber" that he was not giving away his secrets, and thereafter he, being a cautious individual, saw to it that all labels or other marks of identification on material or chemicals used were removed as soon as they arrived.

When the cyanide copper sol. turned blue, it was to give her a chunk of that "white stuff"; when she blistered, give her some more, and when she refused to plate, give her still more; also, in all cases "give her another chunk of that white stuff." Finally the boss would stay after working hours, and, according to his version, "dope her up." One morning this same tank, having developed a leaky condition, some of the solution disappeared, and, being afraid that the boss would discover it (as he held the scrubber morally responsible for all such occurrences), your humble servant took the hose and administered a goodly amount of "aqua." "Oh, joy," the result was batch after batch of that nice red deposit turned out and no trouble. But when the boss arrived and was informed of the results thus obtained, as a compensation the scrubber was told in very abbreviated remarks and limited time to "fade away" for spoiling that valuable solution, and furthermore if there was any doctoring to be done "he" would administer the medicine—"so clean out."

This I cite to illustrate what has been a prevailing fact in our craft, and I am glad to know and to realize that this calibre of a plater is fast disappearing and his day of judgment has arrived.

The trade journals have proven a great factor in removing this mysticism which has so long existed and have paved the way for education and enlightenment of the present-day plater.

The plater of the future must be a man of theory as well as of experience, and as there are no more secrets in deposition of metals, he must be competent to manage his department on a strictly efficient basis. He must be broad-minded and quickly adapt himself to new conditions which may arise. The employer of to-day is on the alert for the man who is able to fill these requirements, and here at your meetings is your school of instruction. "The Review," that valuable little pamphlet which conveys to you the experience of some of the best platers in the country, will prove a valuable adjunct.

The manufacturers apparently have taken a deep interest in the association, which was much demonstrated at the open meeting and banquet of the Chicago branch last December, also by the number of members we have on the roster whose dues are being paid by their employers. These same employers must eventually be the gainers thereby, as the problems and discussions brought up at these meetings cannot but prove beneficial to their foreman platers who will strive to emulate their adversary's example.

I believe the branches in their respective states should seek proper legislation in order to better the sanitary conditions of the plating room, because the occupation even at its best is not a healthy one, and too much stress cannot be laid on the proper removal of poisonous fumes or gases arising from the various operations. This alone would prove a great accomplishment. Very little consideration

has been shown in the selection of proper locations for the plating and polishing departments. In many cases it may have been the plater's own fault and he has had to suffer the consequences.

I believe that the manufacturer is willing to extend his aid and co-operation in eliminating these unfavorable conditions, and this must invariably be to his benefit.

At last, a little social intercourse and the display of fraternal spirit can not but make friends and will tend to bury that evasiveness and skepticism which has so long prevailed. No plater who is ambitious and wants to advance can afford to be an outsider. It is only a question of time that will bring him to that primary realization that in "knowledge is power."

The American Electro-platers' Society

*J. H. HANJOSTEN, Supreme Vice-President

Mr. Toastmaster and Gentlemen:

I wish to congratulate you gentlemen of St. Louis on the splendid record you have made. With a comparatively small membership you have accomplished much. Keep up the good work and do not falter. Your reward will be sure, conscious of the good work you have done and of a duty you have performed your own self. Satisfaction will repay sufficiently for your labors. Keep it up.

Note the suggestion of Mr. Lamoureux that a small item neglected makes quite a run in a year and continues from year to year.

I am very glad to be with you to-night and I am happy to address you on a subject that is of so much interest to all of us.

Your secretary informed me that my subject would be "The American Electro-Platers Society," and I thought, when I received his letter, that you could very easily have found some one more able than I, someone who could more nearly do that subject justice.

For it is to us, and to our employers as well, a subject of vital interest, and I shall endeavor to make clear to our guests, who are not members of our Society, its aims and objects, and if at times I may seem to digress from my subject, it will only be to touch upon some matter that seems to be within the province of the subject assigned me, or to prod some hesitating someone into activity, to get him to take his stand where he belongs, or make someone think differently on some matters, than he has heretofore, or start him thinking on matters that he has not given a thought to, up to now.

Section 2 of Article 1 of our constitution reads: "The object of this society shall be the advancement and dissemination of knowledge concerning the art electro-deposition in all its branches. All laws and rules must be so formed that the society will promote no other object than the education of its members in all the principles of electro-deposition and the coloring of metals."

I quote the section in full because it explains the object of our society better and more fully than any words of mine could. Education, and the mutual assistance gained through education are the benefits we derive from our membership, and educating the plater in his profession is the first and greatest, and I may add the only object of our society. For may we not justly call the aid we get from our fellow members in helping us solve some problem that taxes our skill or experience part of an education that we get by associating ourselves in a society such as ours? True, our meetings promote good fellowship and a fraternal spirit that cheers the weary and raises the spirits of the down-hearted brother plater, who may have been wrestling with a problem that has puzzled him during the day, but that good fellowship and fraternal spirit is prompted by the knowledge that through his society the plater can appeal to his fellow craftsmen for aid that will help him overcome his trouble, and in his breast is kindled a desire to return the favor, and help some other, as he has been helped.

But a few short years ago the art of electro-plating was enveloped by a cloud of mystery so black and deep, that a Mississippi Valley fog would seem like high noon on a cloudless June day compared to it. And even to-day there are a few platers who still hug the delusion that their art is their own sweet secret, and some of them still strut around like the boy who knows something but won't tell, with the expression written all over their manner and bearing that says plainer than words, "I know something you don't know."

True this class of platers is much smaller than of yore, and with the onward march of progress is diminishing so fast that it will soon be with the snows of yester-year. And as platers they will be buried, unwept, unhonored and unsung. But let us leave them and not be too severe with them, for many of us remember them as good and kind men, men whom we in our younger years looked up to with admiration and wonder, for they knew something we did not know then, something that was very wonderful to us, when as youngsters we saw them mix solutions, and thought the miracles they performed the most wonderful thing our young lives had ever witnessed.

I have in mind one of them now, a kind, gentle and lovable man, soft spoken and gentle mannered, who was always willing to overlook our outbursts of youthful exuberance, his gentle rebuke always hit in the place where he aimed it, and he planted more good resolutions in my youthful mind than any other man I ever knew. I

always respected and loved him, and I shall honor his memory to my dying day. If he were living to-day, I believe he would be a member of our society, but I know it would break his gentle old heart to hear the things that were to him cherished secrets, so freely discussed in our meetings.

The breeze that has scattered the clouds of mystery before it, has gained in volume, until its strength has become that of a cyclone, and has swept before it every last vestige of the old orthodox beliefs, and in their place there is to-day the true gospel of education being preached by the American Electro-Platers Society. Its slogan "knowledge is power," is known and appreciated by every plater in the United States and Canada, be he a member of the society or not. But whether he is or not, the plater everywhere to-day recognizes the fact that if he wishes to keep step with the onward march of progress, he must educate himself in his profession, and more and more, throughout America, platers are beginning to realize that the education they need can be gotten through association and by exchanging with one another ideas and knowledge gained in practical experience.

It was for the purpose of exchanging ideas, of trading experience that the American Electro-Platers Society was formed. Under the leadership of our honored friend, Mr. Charles H. Proctor, a handful of men, fewer in numbers than the Branches of the Society now number, met in the Astor House in New York City, hardly five years ago, and there laid the foundation for the splendid structure, that was to become in the future a monument to their energy and progressiveness.

The early days of the new Society were not all peaceful and much opposition was met. Many platers, to whom the principles for which the new Society stood appeared sacrilegious, were bitterly opposed to it, and many openly spoke against it, prophesying dire calamities to the plater in general if a society that had for its primal object the dissemination of knowledge concerning the art of electro-deposition were allowed to live.

Then, too, there was the agitator who tried to force his way in. But the wisdom of the founders was great and their resourcefulness equal to every emergency. The society emerged from out of the gloom, its name as an educational society unsullied, and questions of wages and labor conditions were forever barred from discussion in its meetings.

For some time the New York Branch, as it is now named, was the only branch. It was the National Electro-Platers Association, and gradually platers all over America applied for admission as members. It soon became apparent to the members not living in New York City or its immediate vicinity, that to get the greatest amount of benefit from their society, they must form branch associations, and the Philadelphia platers, under the leadership of Mr. Fred C. Clement, our able Supreme Secretary, applied for a charter

to form a branch society in their city, which was granted by the National Body.

Within a comparatively short time, Rochester, Toronto, Indianapolis, Detroit and Chicago fell in line, and a short time later you gentlemen formed a St. Louis Branch. Since then several other cities have become the homes of branch societies, all having but the one object in view, that is, the education of its members in the art of plating.

In dwelling so persistently on the educational features of the society, I do not wish to give the impression that it is only by discussing platers' problems in our meetings that we educate or that the society is the only school that is necessary to give the plater a finished education, as a plater. But I do wish to impress on your minds the fact that in our meetings every phase of chemistry and electro-chemistry relating to the art of electro-deposition is discussed. Perhaps no class of men more fully realize the benefits of a technical education. Hence we encourage our members to study every detail of plating, and treat it as it should be treated as a science. A number of our branches hold their meetings in the laboratories of institutions of learning where experiments and demonstrations are made, and where men with both theoretical and practical knowledge convert theory into practice, and the plater with limited experience gains in a short time an amount of knowledge of his profession that it would take him years to obtain, by studying alone.

The experience of his fellows is his for the asking, and is at all times freely and cheerfully given, nor does the man giving of his store of knowledge miss it or begrudge it, for he knows that the many have more knowledge than one, and he appreciates the fact that his own application for enlightenment will receive the same consideration as that given to the question of his brother member.

Through the Supreme Society, which is the governing body, the fruits of the labors of the Branch Societies are spread among the members. The papers read at the different Branch meetings are published in the "Quarterly Review," and so reach every member, so that no matter where a member's home may be, he gets the benefit from the labor and researches of every branch. The Supreme Society publishes the *QUARTERLY REVIEW* and the *BULLETIN*, the latter a monthly periodical devoted to items of interest to the craft.

The Supreme Society also maintains a Bureau of Information to which any member can apply for information on any subject relative to electro-plating. It also maintains an Employment Bureau, through which members are aided in securing positions.

You will admit, gentlemen, that some labor is necessary to do all this, and yet we have no salaried officers in our Society. Every particle of work done is a labor of love, the only reward that we expect is that we will be better platers, the only reward that we give to our officers is the appreciation that we have for their work, and all their pay envelope from the society contains is "Well done, good

and faithful servant." I will not even say that we honor them by making them our officers, for the honor is all on our side. For we are truly honored in having such men as Messrs. Hogaboom, Barrows, Clement, Schultz and Taylor as Supreme Officers, and I know that every member appreciates the work they are doing, and they will find their reward in the grateful appreciation that is in the heart and mind of every member of the American Electro-Platers Society.

That the work the Society is doing is appreciated by manufacturers is becoming more noticeable every day, for many manufacturing concerns are urging their platers to join the Society and many of them pay their initiation fees and dues. The wise manufacturer knows that a good man is a good investment, and knows that a Society whose sole aim and object is the education of its members cannot be otherwise than worthy of support and encouragement. And we appreciate your appreciation. We want your good will, and we assure you that you will gain by being our friends.

The position of the average plater is an isolated one, insofar as men of his profession are concerned. He is in most cases the only plater in the factory where he is employed, and cannot go to any one for advice or help very easily. If, however, he is a member of the Society, he knows the man or men who can on short notice help him. Is not this of great value to any employer? How often does the work in the plating hold up an order, because something is wrong? It may be just a trifle, but it becomes a very important matter when perhaps it throws the entire factory system off the track, and yet, by calling on his brother platers for aid, it may be adjusted in a short time, and time, money and worry saved.

But our ambition soars even higher than just helping the plater out of difficulties. We want to place the plater and his art on a higher plane. We want the plater to treat plating as a science, for it is a science both difficult and complex. We want the plater to become so thoroughly familiar with the science of plating that the difficulties now so often encountered in his vocation will become things of the past. Will this not benefit the employer as much and more than the plater? It will mean increased efficiency, which in turn means a product of higher quality and a lower cost of production.

And we can attain our goal, and attain it only by associating ourselves as we have in an educational society, such as ours is.

Let me say to the plater who is still groping in the outer darkness to come on into the light. You will never regret it. You will be welcomed with open arms. If you are a pessimist, and see nothing but the wrong side of this world, I know of no better cure for your disease. For pessimism is a disease pure and simple. Somewhere in this grand old world there is a niche for all of us, and it is up to you to hunt it and find it. And if perhaps you don't fit in very snug and tight, get the right kind of nourishment and fill out. And the right kind of nourishment for you, brother plater, is education.

Learn to know your profession as you know yourself, and then learn to know it a little better. Get in with your fellow craftsmen, come to your meetings and learn, and life will lose its somber hue, and though the cornucopia in fortune's arms may never be tilted your way quite as much as you would like, remember that there are many things in this world besides money. And the greatest of them is the knowledge of duty well done, of services faithfully performed.

You may think that we have mapped out an extended program for ourselves. We have. But with your co-operation, and with the aid and support of the progressive platers of America, we know that we can carry it out. In answer to the question, as to whether we will attain our object, you will hear ringing through the United States and Canada, We Will.

*Foreman Plating Department, Globe Stove & Range Co., Kokomo, Ind.

A good oxidize to take the place of sulphuret may be had by saturating a lye solution with sulphur. It is said that this oxidize will last longer than the sulphuret oxidize.

A good black can be gotten by saturating a cyanide solution with arsenic. The solution must be saturated or the work will smut or smoke. Use hot and in an iron tank with a low voltage. Take the work out as fast as it is covered.

A good black may be had by using one pound cyanide and one-half pound arsenic to one gallon. Use hot, with brass anodes.

Use of Potassium Carbonate in Silver Solutions

BY FRANK C. MESLE*

EFFICIENCY in the plating room means not only the handling of the help to best advantage, but also having every gallon of solution in condition to get from it the best service possible.

I believe all platers will agree that the solution from which we can get a good deposit of a given weight in the shortest possible time, which means the highest current density (amperes per sq. ft.) and with the lowest electro-motive force, is the most efficient plating solution.

I am not sure that the electro-motive force is of much importance to the average Plater since most Platers seem to have enough current and use a portion of it heating their resistance coils.

It is not the purpose of this article to discuss the correct amount of silver or free cyanide that should be used in a plating solution, as this depends upon the class of work being plated—but my purpose is to present a few thoughts regarding the advantage of conducting salts, especially potassium carbonate (K_2CO_3) in a silver plating solution, and the extent to which they aid in producing an efficient plating bath.

Some seem to be of the opinion that the best silver solution is one that is "pure," *i. e.*, having only silver and cyanide in it, but even if this were true, it would be extremely difficult, if not impossible, to use a silver solution for any length of time and not have an increase of carbonate caused by the decomposition of the cyanide. It is the experience of most Platers that a new silver solution does not work well at first, but does better work when it has "aged." We assume this is because the "aged" solution has increased its carbonate content, hence works better. Carbonate, either potassium or sodium, increases the conductivity of the bath, and admits the use of a higher current density, thus giving a heavier deposit in less time. This, of course, is an increase in the efficiency of the bath, but this increase in the efficiency continues with the addition of carbonates only up to a certain point, and past this point, it increases the resistance of the bath instead of the conductivity, which, of course, means a decrease in solution efficiency.

It is frequently assumed that conductivity of a solution increases with the density, but this is not true of all solutions. Dilute Sulphuric Acid, for instance, has a greater resistance at a gravity 1.4 than at 1.2. (See Table No. I.)

The same is true of a Sulphate of Zinc solution. The resistance of this solution is 11.1 ohms per cubic inch at a specific gravity of 1.2709 and 11.5 ohms at 1.3288. (Table No. II.)

I am aware that a solution of high density is of advantage only in so far as the increase in current density will aid in laying on a smooth soft deposit of metal.

With this in mind, I give the results of some experiments we have made in which Potassium Carbonate played an important part.

A regular double silver cyanide solution was made up in the usual way with 4.50 oz. potassium cyanide per gallon and $3\frac{1}{2}$ oz. silver. The maximum current density that could be used with this solution was 5 amp. per sq. ft. A higher current density produced a rough or "burnt" deposit. A solution with the above mentioned amount of silver and cyanide should do good work with a higher current density. Ordinarily, we would say "it is a new solution, it will do better after it has been used for a few weeks" or "after it 'ages'" This means it would be used until cyanide is decomposed or potassium carbonate is added to the solution. We brought about an artificial ageing of this solution by adding potassium carbonate, putting in 4 oz. per gallon. This change admitted the use of 6 amp. per sq. ft. cathode surface. Another four ounces potassium carbonate was added; we now doubled the current density and received a soft smooth deposit of silver. The solution that at first would not lay down a good deposit at 6 amp. by adding 8 oz. potassium carbonate, the efficiency of the solution was increased more than 100%. Another four ounces potassium carbonate was then added, but this did not increase the efficiency of the bath 50% as might be supposed it would. The increase this time was only about 8%, as a good deposit could not be produced at a current density higher than 13 amp.

Further additions of potassium carbonate seemed to make little or no difference in the nature of the deposit at a current density of 12 amp. up to 20 oz. per gal., except that it did increase the resistance of the solution about 200%, 12 A requiring one volt with 8 oz. potassium carbonate per gallon and nearly 3 volts with 20 oz. potassium carbonate per gallon, with no improvement in the nature of the deposit. At 28 oz. potassium carbonate per gallon, we could not get more than 6 amp. per sq. ft. with 3 volts.

We might put it thus: the efficiency of a silver solution with 4.5 potassium cyanide and 3.5 silver can be doubled by the addition of from 8 to 12 oz. potassium carbonate per gallon, but if twice that amount is added, say 24 oz., the efficiency drops off about 100%, or in other words, twice as much work can be done in a solution with from 8 to 12 oz. potassium carbonate per gallon than in a solution without potassium carbonate, as in a solution with too much potassium carbonate in the same length of time.

Potassium carbonate in a plating solution is of advantage only up to 12 oz. per gallon.

Table No. III. will give a good idea of the results we are trying to tell about in the above.

RESISTANCE OF DILUTE SULPHURIC ACID.

(Jamin and Bonty.)

Den- sity	OHMS PER C. C. AT				OHMS PER CU. IN. AT			
	0° C. or 32° F.	8° C. or 46.4° F.	16° C. or 60.8° F.	24° C. or 73.2° F.	0° C. or 32° F.	8° C. or 46.4° F.	16° C. or 60.8° F.	24° C. or 73.2° F.
1.1	1.37	1.04	.845	.737	.540	.409	.333	.290
1.2	1.33	.926	.666	.486	.524	.364	.262	.191
1.25	1.31	.896	.624	.434	.516	.353	.246	.171
1.3	1.36	.940	.662	.472	.535	.370	.260	.186
1.4	1.69	1.30	1.05	.896	.666	.512	.413	.353
1.5	2.74	2.13	1.72	1.52	1.16	.838	.677	.598
1.6	4.82	3.62	2.75	2.21	1.90	1.43	1.08	.870
1.7	9.41	6.25	4.23	3.07	3.71	2.46	1.67	1.21

RESISTANCES OF SULPHATE OF ZINC AT 10° C. OR 50° F.

(Ewing and MacGregor.)

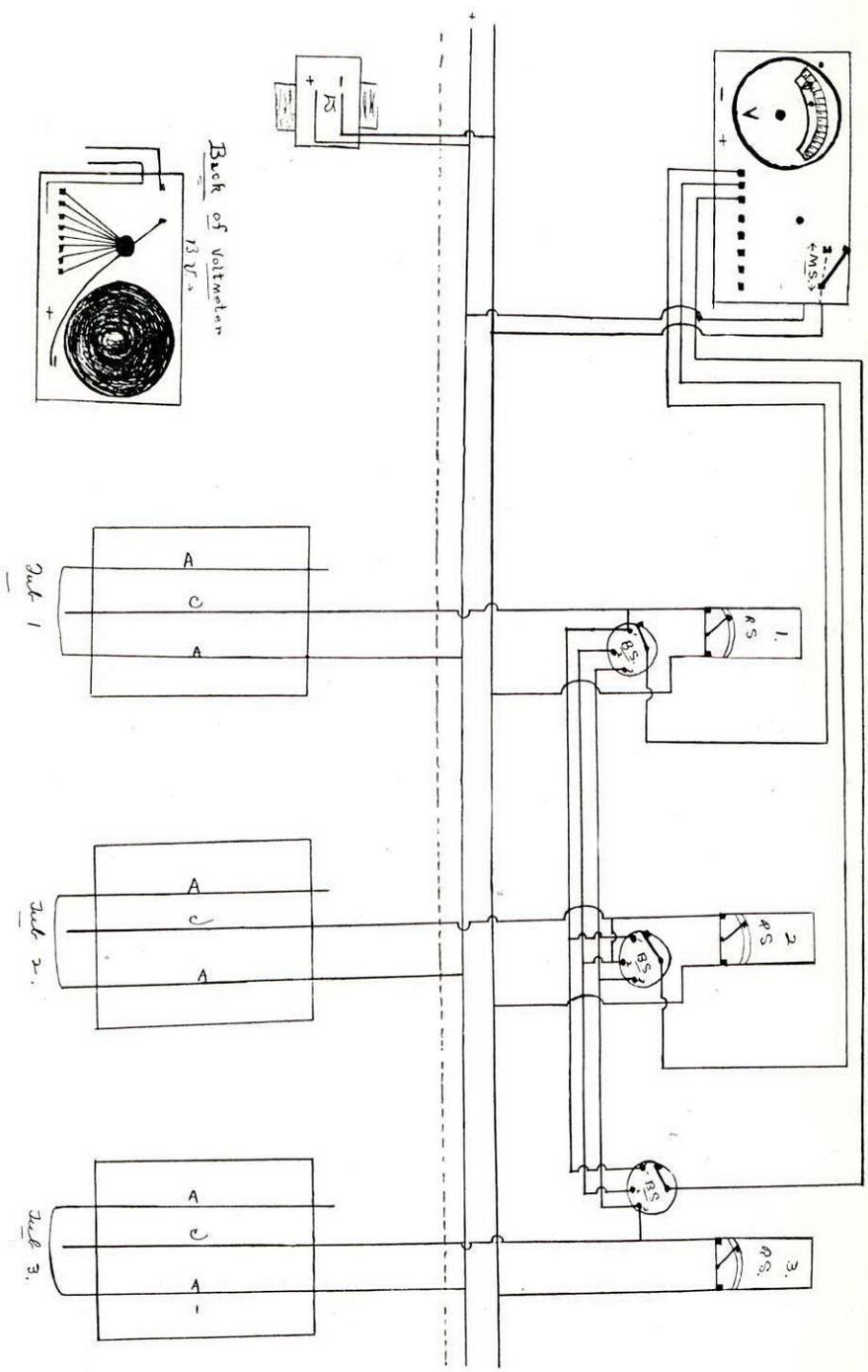
Density	Ohms C.C.	Per Cu. In.	Density	Ohms C.C.	Per Cu. In.
1.0140	182.9	72.0	1.2709	28.5	11.2
1.0187	140.5	55.3	1.2891	28.3	11.1
1.0278	111.1	43.7	1.2895	28.5	11.2
1.0540	63.8	25.1	1.2987	28.7	11.3
1.0760	50.8	20.0	1.3288	29.2	11.5
1.1019	42.1	16.6	1.3530	31.0	12.2
1.1582	33.7	13.3	1.4053	32.1	12.6
1.1845	32.1	12.6	1.4174	33.4	13.2
1.2186	30.3	11.9	1.4220	} 33.7	13.3
1.2562	29.2	11.5	Saturated		

From Taster's Electrical Engineers' Pocket Book. Page 1231.

Oz. K ₂ CO ₃ Per Gal.	Current Density	Volts	Nature of the Deposit
00	3.50	.55	Hard white plate.
00	6.00	.85	Very white and rough on ends.
00	9.00	1.25	Very rough and "burnt."
00	12.00	.....
00	13.00	.....
8	3.50	.45	Soft smooth plate.
8	6.00	.7	Soft blue plate, very good.
8	9.00	1.00	Soft blue plate, very good.
8	12.00	1.30	Soft blue plate, very good.
8	13.00	1.4	Soft blue plate, slightly rough on ends.
24	6.00	2.7	Soft smooth deposit.

With a pressure of three volts we could not get more than six amperes per square inch of cathode surface.

*Buffalo Branch.



Arrangement of Voltmeter

THE design on opposite page illustrates how my voltmeter is connected with the plating tubs. I bought a Model 57, Weston Flush Type Voltmeter, and material, and made my own voltmeter switchboard. The dimensions of my box are, 20 ins. long, 11 ins. high, and 5 ins. wide. The voltmeter and wires are all enclosed in box, which has been given several coats of black paint, both inside and out. No. 18 or 20 bell wire can be used in connecting up the 3-point bell switch. I used No. 14 insulated wire for the rest of the wiring.

By the use of the 3-point bell switch, it enables the plater to ascertain the voltage of each tub, at any one tub, by keeping each switch thrown open. For instance, if I stand at Tub No. 1, I will close the lever on point 1 of the bell switch to find the voltage of Tub No. 1; and without moving from Tub No. 1, I can tell how many volts Tub No. 2 is using by placing the lever on point 2; and Tub No. 3 by placing the lever on point 3.

The switches must be kept open when you leave the tub. That is, if lever of bell switch at No. 1 tub, is on point 1, and I am standing at Tub No. 3, I would not be able to tell what voltage I am using on Tub No. 3. I would first have to walk over to Tub No. 1 and remove the lever from point 1 and place it on point 3, before I would know how much current Tub No. 3 is using.

Any number of tubs can be operated on the same plan. Should the plater need fifteen tubs, he would then require a 15-point switch, which can be connected up in series, same as diagram.

By closing the main switch on voltmeter switchboard, you will ascertain the voltage the dynamo is generating. This switch should also be thrown open when you are through with it. However, the rheostat switches 1, 2 and 3, should be closed so that the current can go into the tub.

It must be understood that point 1 on the bell switches shows the current used in Tub No. 1. Point 2 will show the current used in Tub No. 2, and point 3 will show current used in Tub No. 3. So you will readily see how easy it is for the plater to walk to any one of his tubs and by moving the lever to points 1, 2 and 3, he can see how much current he is using at each of his tubs, without moving.

AUGUST WM. KONDER,
Philadelphia Branch.

A.—Anode.

B. S.—3-point Bell Switch.

C.—Cathode.

D.—Dynamo.

M. S.—Main Switch on Voltmeter Switchboard.

R. S.—1, 2, 3, Rheostat Switches.

V.—Voltmeter and Voltmeter Switchboard.

B. V.—Back of Voltmeter Switchboard showing how wires are connected.
They are all soldered to a brass plate.

Newark-New York Banquet

THE fifth annual banquet of the Newark and New York Branches took place on the evening of February 21st at the Marlborough-Blenheim Hotel, New York City. About one hundred and seventy guests took advantage of the hospitality offered by these branches and they each and every one had an enjoyable evening. At the speakers' table were Mr. Charles H. Proctor, Mr. George B. Hogaboom, our Supreme President, Messrs. Thomas B. Haddow and J. A. Stremel, President and Vice-President of the New York Branch; Mr. Horace H. Smith, President of Newark Branch; Dr. W. A. Jones, Professor William Wiener, Principal of Newark Central High School and our old friend, Smiling Bill Schnieder, chairman of the Banquet Committee.

President Haddow acted as toastmaster until his voice gave out and then President Smith took his place. The affair was most successful in every respect and the committee desires to thank all who helped make it so.

Mr. Joseph Walters, of Richmond, Va., read a paper on "Electro-Plating: Is it a Trade or a Profession?" His address was most interesting in every respect and made most of the members present feel proud of the fact that they are platers.

Professor Wiener's talk was most interesting and he stated that in order to be successful he must follow the business for which he was best fitted.

Mr. Charles H. Proctor, founder of the Society, spoke a few words appropriate to the occasion and congratulated the two Branches on the progress they had made. Supreme President George B. Hogaboom then recounted the objects and benefits of the Society.

Mr. Wm. Schnieder then spoke interestingly of his various experiences and stated that in order to have a highly efficient plating department a plater must and should have the same advantages as any other part of the shop. Vice-President Stremel's speech was interesting and is published below.

The badges used were furnished by the Maas-Waldstein Company, Newark, N. J.; the menu cards and souvenirs were furnished by the Celluloid-Zapon Company, the Roessler & Hasslacher Company provided for the printing and the Celluloid-Zapon Co., Egyptian Lacquer Co. and Roessler-Hasslacher Company furnished the cigars. The Metal Industry supplied the registration staff and furnished the type machine.

The display of the work done by the members was so good that it caused many to scratch their heads and say, "Gee, I wonder how that was done."

Vice-President Stremel's Speech

Fellow Members, Guests of Honor and Friends of our Society: It affords me great pleasure to greet you this evening on behalf of the New York and Newark Branches and bid you all welcome to partake of the good things which have been prepared for us, and which are offered, and I trust will be enjoyed with the same goodly spirit as the dusky southerner breaks bread with the passing stranger.

At this, our fifth annual banquet, we no longer meet as the parent body of this grand society, which has for its aim the educational uplift of its each and every member, but humbly we take our place in the rank and file of the Branch Societies, having had the paternal yoke lifted from us by the formation of the new Supreme Body, representing all of the various Branches.

I avail myself of the opportunity to publicly commend the members of this body who have persevered in the work of developing and guiding the Society to its present lofty position in the eyes of the plating fraternity.

The work was hard and as the Society grew, business likewise increased and much time which might have been given to the discussion on plating, finishing, etc., was sacrificed to problems of organization so that others might learn of and be benefited by the Society. Now that we have been relieved of this responsibility we find that our progress has been greatly impeded while other Branches have flourished and established methods of educating themselves in the theory and chemistry of electro-plating and finishing. A widely scattered membership also is ours, it ranging from coast to coast, from north to south of the States, making it impossible for many of its members ever to attend a meeting. And the withdrawal of the Newark members also cut into our ranks and we lost several earnest workers by the formation of that Branch. Then, too, business takes some of our best men to other parts of the country and we greatly miss the regular attendance of such live wires as our Founder and First Past President, Mr. Chas. H. Proctor; Supreme President, Mr. George B. Hogaboom; Mr. Percy S. Brown, Mr. Schneider, Mr. Sliter and our elected President, Mr. Thos. B. Haddow.

But we have been leaders in the past and hope to continue as such and plans are now under way in our New York Branch to secure a laboratory and the services of an instructor that its members may become proficient in both the theoretical, chemical and practical sides of electro-plating. Therefore, I extend this evening a most cordial invitation to all Foreman Platers who are as yet not members to come and join us and share the benefits to be derived from a membership in the A. E. S.

And now I hope you will all have a most enjoyable evening and listen to what the speakers of the evening have so kindly agreed to say to us.

Dayton Banquet

On Wednesday evening, February 24, Dayton held their first annual banquet in the Banquet Hall of the Y. M. C. A. This Branch deviated somewhat from the course usually followed by the Branches and had their wives and friends present in order to make the evening more enjoyable. Owing to the inclement weather and heavy snows, the attendance was slightly less than the committee had anticipated. However, that which was lacking in numbers was partially made up for in the good spirits and enthusiasm displayed.

Letters of regret were read from Supreme Vice-President Hansjosten and Founder Charles H. Proctor on their inability to be present, but their well wishes were present nevertheless.

After the good things had been partaken of, the Chairman of the Banquet Committee, Mr. A. Lamoureux, introduced their president, Mr. Walter Fraine, who acted as Toastmaster for the occasion. President Fraine, in a few well chosen words, spoke of the feeling of pleasure it gave him to see so many present. "This showing," he continued, "speaks well for the future of the Dayton Branch."

Mr. A. Lamoureux, Secretary of Dayton Branch, then outlined a brief history of this Branch and spoke very encouragingly of the future. He then proceeded to read a paper written by his brother, Mr. E. Lamoureux, of the Chicago Branch, on "Efficiency, Business and Technical Ideas of Electro-Plating." This was received with much enthusiasm as Mr. E. Lamoureux was responsible largely for the formation of this Branch.

Impromptu remarks were made by Messrs. Henry A. Creamer, of Springfield, Ohio; Joseph Keyes, proprietor of the Dayton Plating Works; Forrest Hartzell, proprietor of the Crown Manufacturing and Plating Company; Elmer Stephens, Wm. Liddy and Robert Sumans, librarian of this Branch. During the evening, the Jones Brothers Quartette rendered selections and they were accompanied on the piano by Mr. Norman Jones.

Dayton has been organized for only one year, starting with thirteen members and at present having an enrollment of twenty hustling members. The future of this Branch looks exceedingly bright and a banquet to the manufacturers of Dayton will be given in the near future.

Duplex or Acid Copper Solutions

ROBERT SUMAN*

A NUMBER of formulas have been given for acid or duplex copper solutions, and I will endeavor to bring out some of the points regarding the same, hoping they will benefit some of our members. Some of these formulas have worked perfectly, while others have proven faulty, although they may have been worked all right by the inventor.

I have always used the following when making a new solution, and invariably have obtained excellent results; I have also noted the following faults and have found the remedies as they are given below. They may not work the same under other conditions as they have worked for me, and other platers may not have the same failures or observe the same faults, as it is often the case that one plater may use the same formula that has been worked successfully by another plater, and find it impossible to obtain good results. I think this has happened to a number of us. Oft' times a plater may have trouble with his various solutions and coloring, and his position necessitates immediate results and production, but after this has been obtained he continues trying different methods, hoping for further improvement. He should not be afraid to seek the advice of some other member who knows, nor be afraid to show his ignorance, as none of us knows it all, and it has happened that continued useless experiments have resulted in the loss of position.

A fairly good solution is as follows:

Water—1 gallon.

Sulphate of Copper— $1\frac{3}{4}$ pounds.

Sulphuric Acid—2 ounces (approximate).

However, I personally have never used this solution, but generally hang the Sulphate of Copper in sacks in the tank until the hydrometer stands at 17 or 18, when I add sulphuric acid until it reaches $1\frac{3}{4}^{\circ}$ more. I then add about one-quarter ounce of alum per gallon, and I have found this to be a good solution which generally starts out right.

Below I enumerate some of the faults which most of us have been up against, and the remedies that I have applied, which may be of some benefit to those not having had the experience.

Rough spots or "pimples" may be caused by a stirred-up solution, small particles of undissolved copper floating from the anode, or too strong a current. To cut out the current or strain the solution usually remedies this condition.

The deposit may be smooth and free from the velvet appearance that is desired on some classes of work. This may be caused by the solution being too low in metal, when sulphate of copper and a small amount of sulphuric acid should be added.

Spots may appear on the surface which refuse to plate, which

may be caused by finger marks or grease, or the article being porous. If the latter, the pores may be filled with grease. If the article is of iron it may not have been sufficiently plated in a cyanide solution or nickeled. Streaks sometimes appear on the work, which may be caused by the grease in the pores or a zinc spot. Streaks are sometimes caused by the current, which can be controlled by the rheostat. I have found that a good remedy for porous metals is to wash them in gasoline or naphtha and dry out in sawdust, or boil well in lye or potash.

The deposit may be coarse or grainy, and unable to stand the buff, when it may possibly brittle off. This may be caused by too much metal being deposited or forced on, or sometimes too much acid, or the edges may be too close to the anode.

Sometimes the deposit may be dark red on the edges and bottom, caused by the acid not being agitated enough or the current being too strong. These conditions also cause the deposit to be dark red and spongy, and the addition of a small amount of acid sometimes remedies this.

Too much metal in the solution may cause the plate to become spongy and not hard enough to buff. The addition of a small amount of acid will remedy this.

When the deposit is not thrown on fast enough a small amount of sulphuric acid should be added or additional current used.

Instead of the bright appearance desired a brown scum may appear on the plate, caused by heavy deposit, weakness of conductive force, or a dirty solution. A small quantity of alum will brighten the deposit; hyposulphite of soda, in small quantities, is also a good brightener.

When the plate is brittle, caused by the solution being too low in metal, the addition of a small amount of sulphate of copper or carbonate of copper is advisable.

A number of platers suggest adding glucose, molasses or gelatine, as these ingredients seem to give the solution a body and to act as a filter, settling at the bottom of the tank. When cleaning out his tanks the Plater will often find them lying on top of the mud or sediment which has accumulated.

When I have known the metal and acid to be in the solution in the proper proportions, and it has worked faulty, I have found that filtering the solution has remedied the trouble.

I have found the "Electrolytic" to be the best anode, as it seems to feed the solution more freely than the sheets, and also acts as a better conductor, as the warts on them give more points of contact to draw from, and the plate is more malleable and soft. I would suggest that if the manufacturers start the same kind of anode for nickle, that they make it rough, as the Plater does not care for a smooth-surfaced anode.

I think the plater's troubles would be partly eliminated if he had less iron deposited than at present, as he would get rid of the mud in his tank and also obtain a whiter deposit.

We can use this solution hot, when it makes a faster deposit, but it must then be filtered more often.

The voltage depends upon the amount of the load and the density of the solution, but I have been successful with a voltage of 1 or $1\frac{1}{2}$ volts.

I do not think that I have entirely covered this subject, and therefore hope that "the other fellow" will help by giving us the benefit of his experience and views.

*Dayton Branch.

Is it a Disadvantage to Pickle Castings that are to be Plated?

By ARTHUR O'KEEFE.

IS it a disadvantage to pickle casting that are to be plated?

I would say—decidedly, yes.

The pickling of castings as far as plating is concerned is a great disadvantage, as well as an extra expense, adding nothing to the beauty of the deposit. It has a tendency, if not thoroughly neutralized, to turn the deposit yellow in the background and causes the extra expense of plating it the second time in order to cover and whiten the deposit, to say nothing about having the solution saturated with hydrophloric acid, which, as is well known, does not improve the working of it.

The pickling of castings, as far as the softening of iron is concerned, is a great advantage in the polishing department, softening the iron to such an extent to make it possible for the polisher to scale his work with the ordinary amount of wheels, which otherwise would be impossible.

Of course, all this trouble could be eliminated if the laborers performing this work of pickling understood the reason for it, but unfortunately this class of work is performed by unskilled laborers who are not familiar with the English language, consequently it is impossible for the person in charge to explain the reasons for the operations, and this accounts for the acid not being neutralized in the pores of the metal.

Another cause of this trouble is that the work is being pickled a portion of the time in nothing but water, owing to the fact that the pickle, through neglect, is not strengthened, while on other occasions it is neutralized in nothing but water.

There are remedies for all these troubles, but they lie with the manufacturers themselves and as the question of money is involved, it is not at all likely that any efforts will be made to improve

the conditions. Nevertheless, I would like to offer a few suggestions along these lines.

If it is profitable for the manufacturer to use that grade of iron, let him confine it to the black castings only, that is to say, use it for all castings that are not to be plated and use a better and also a softer grade for ornamental work or work to be nickle plated. By working along these lines, the use of hydrophloric acid could be done away with entirely, an item of from seven to ten dollars per day and a better grade of work would result.

This subject was prompted by a question asked by some member of the St. Louis Branch, striking me very forcibly at the time, due to the fact that I have had trouble of the same character.

President Detroit Branch.

Silver Plating

By J. E. YOUNGER,*

Foreman Plater Elgin Silver Plate Co.

I PRESUME all of you understand the underlying principles of this subject and I sincerely beg to be relieved from the embarrassing position this article finds me while submitting to you; not given in a suggestive nor in an instructive nature, but given in a spirit that befits me best at this time,—the spirit of A. E. S. To you, my Brother Platers, I will be pleased to rely on your kind indulgence for a few moments. Necessity compels me and necessarily confines me to that well trodden path which brings me face to face with that old familiar subject, Silver Plating. In selecting this as my subject I believe I owe an apology in presenting one that has been written about as much if not more than any other subject pertaining to the art of electro plating; but I think it still remains one of the most interesting subjects in the world of electro deposition of to-day. Silver is considered one of the most prominent metals in electro deposition processes. Why? First, because silver is one of the virgin metals, significant for its exquisite color, capable of such a high lustre and brilliancy when the proper method of polishing is employed, either on the metal itself or on the deposited surface; second, because it is one of the three distinct colors of metals of the world—thus, gold is yellow, silver is white and copper is red; third, because of its useful and far superior qualities as a non-corrosive metal for silverware, domestic, commercial and many other purposes where no superior substitute has ever been offered, and because of the intrinsic value of the metal itself. Although in actual amount of metal, there can be no comparisons made, with some of the inferior metals in amount of metal deposited, but in actual value will equal, if not exceed, any other metal in actual value of metal deposition.

There are a great many different salts of silver. Some of the most common are, the chloride, nitrate, carbonate, oxide and sulphides. The sulphite and acetate and other salts have been tried, however, for electro plating, but the one that has stood the test of time and gives the best satisfaction is the double cyanide of sil. and potassium. There are a number of methods of constructing a silver plating solution and each plater has as many of his own private opinions in regard to making and maintaining the solutions as there are different methods. A few of these methods I will endeavor to explain as I proceed with this article. There are also a number of peculiar circumstances in connection with the deposition of silver, such as the composition of the electrolyte, specific gravity, temp., current density, or actual amount of current entering a certain amount of surface in a given amount of time, and also the surface of the article to receive the deposit. From actual experience with a number of electro plating baths not necessarily sil. I have observed that these circumstances present themselves in about the same way, but as silver is the subject at hand, I will endeavor to confine myself accordingly. The circumstance which has the greatest effect on the quality and purity of the deposited metal is the composition of the electrolyte; the circumstance that affects the deposit the most is the current density, in other words, the amount of current entering the cathode or receiving surface in a given time.

In silver plating the operator must exercise considerable care in handling the proper and necessary amount of current, as the difference in the solution temp. and amount of cathode surface requires to be electrolysed at a different rate before satisfactory results can be obtained. From experience gained through considerable silver plating I am convinced that a perfectly smooth, bright surface is the best to receive a silver deposit. If the surface should be rough, therefore the deposit will be rough also. If of an irregular shape, with many sharp protruding points, etc., it will require very careful manipulation of rheostat and the correct amount of anode surface in proportion to the cathode surface must be maintained before any degree of success can be accomplished. As the deposit increases in thickness it has a tendency to become uneven, and in nearly all cases will lose its reguline character and brightness. The edges of the cathode which receive the thickest deposit are the quickest affected. Therefore it will be necessary to resort to a mechanical operation such as scratch brushing or buffing in order that the smooth surface will be restored again. It is customary for a great many platers to use a silver solution containing one-half oz. or less of silver to the gal. and add a great excess of potassium cyanide to make it conduct freely. There are some advantages in operating solutions formed in this manner. It also has its disadvantages. The only advantage is in its being comparatively inexpensive in its first formation. Solutions formed in this manner will deposit very rapidly and yield metal of an average character, but when that fine unsurpassable white deposit, so characteristic of this metal, is

desired you will find this formation to be greatly in error. Solutions so constructed are very troublesome to operate, especially in hot weather. The anodes dissolve with great rapidity on account of the great excess of potassium cyanide. A good depositing solution should dissolve the anodes freely, however, and at the same time contain the proper proportion of silver to the gal. or solution, and have very little effect upon the base metal, because it is such metal we wish to deposit upon. The addition of silver salts to potassium cyanide solutions may be worthy of mentioning at this time in regard to the effect some of the various salts produce. With the exception of the cyanide of silver salt most all other salts have some effect when added to potassium cyanide solution. For instance: If we should add the oxide of silver to a potassium cyanide solution some of the cyanide will be converted into potassium hydroxide or caustic potash. If carbonate of silver should be added to potassium cyanide solution potassium carbonate to a certain extent will be the result; the same by adding silver chloride potassium chloride will be formed and so on, with many other salts of silver. Each of the salts, especially the chloride, diminishes the action of the electrolyte upon the anodes, decreases the dissolving power for cyanide of silver, and will to some extent act on the cathode surface, also in many instances interfere with the adhesive properties of the deposit. Some electroplaters are inclined to believe that these salts are not injurious to a plating bath, but I think some of you will agree with me that they are highly detrimental. For illustration, excerpt from the works of an authoritative chemist: One hundred ounces of silver chloride added to a potassium cyanide solution will produce about 69 ounces of potassium chloride as an impurity in the solution. Of the same amount of silver converted into silver nitrate will produce 93 ounces potassium nitrate as an impurity when added to a potassium cyanide solution. Therefore in constructing a silver plating solution the double cyanide of silver and potassium salts from a chemical standpoint are far superior to any other silver salt for making and maintaining a silvering bath. After a brief description of a few of the circumstances connected with silver plating I have arrived at the most prominent circumstance of all, the making or forming of the electrolyte. Some of the text books on electro plating give a number of ways of forming silver solution, but experience prompts me to believe that there are only two reliable ways of doing so. Chemically and electro chemically. I will endeavor to explain a few things in forming a solution in the electro chemical way, or dissolving the silver direct from the anodes. The silver anodes for this method should be "fine" or as near pure as possible to be had. This method I know will seem ancient or prehistoric to some of you, and I believe I could be easily convinced of the fact that there are but a few platers of modern times who still employ this method of forming a depositing bath but nevertheless is considered a very good method, especially for small solutions where plating is done on a small scale, and where the plater has not the proper place or

facility for precipitating his silver chemically. There are not many accessories required for dissolving the silver from the anode. A few porous cups, size and number depending on the amount of solution that is to be made; a piece of heavy copper wire coiled up to resemble a close spring, with a hook formed on one end will act as the cathode. The coil should be about one-half the diameter of the cup, with plenty of space between coil and cup and about one inch shorter than the cup that is to be used. These are round cups that I have reference to. Cups of other shapes can be fitted up accordingly. In suspending cups in position all that is necessary is to put a small hole about one-half inch from top or upper edge, exactly opposite from each other, a small wire attached to each hole and formed into a suitable hook so it can be hung on the cathode or negative rod, having the porous cup properly fitted up. Next fill tank, or jar, with cold water to about two-thirds the depth that is to be used for plating. Then add four ounces K C N to each gallon of water in tank. After the potassium cyanide has thoroughly dissolved get the exact weight of anodes, hang in the solution in proper position, connect anodes with positive rod. Then with the proper amount of K C N in solution, anodes in proper place, with porous cup suspended from the cathode rod to the correct depth, so none of the potassium cyanide solution can enter the cup. Then place the coil, or cathode, inside of cup so they will hang suspended from the cathode rod, entirely free from touching the cup. Now add a concentrated K C N solution to cup, turn on the current. As much current as possible should be sent through the solution without causing too much gas to generate at either pole. If no action takes place inside of cup add more potassium cyanide to cup, which will increase the action. The current should be continued until about $1\frac{1}{2}$ ounces of silver is dissolved from the anodes. This can be determined by weighing the anodes again. If the proper amount of silver has been dissolved and the solution gives a nice, fine-grain, white deposit the solution should be all right. Fill up tank to the required depth. It will now be up to the operator to use his good judgment in regard to the amount of current necessary to get desired results. If after using the solution it becomes low in metallic contents, the porous cup suspended for a short time will bring the solution to the right metallic proportion again. The color of the anode is considered by most operators to be the best guide in operating a silver solution. The anodes while the current is passing should be of a gray color, then the solution is O. K., but when the current is interrupted they will turn to a perfect white color. If the anodes appear white while the current is passing this will indicate too much K C N in solution. It is then necessary to add a silver salt or draw in enough metal from anodes by using the porous cup. If the anodes assume a very dark color while the bath is in action and persist in remaining so, this indicates a deficiency of potassium cyanide.

In making solutions by the chemical process I will endeavor to confine myself to two of the most extensively used, the double cyanide of silver and the chloride; both of these salts have predominating features, in fact, one will give the most satisfactory results of any silver salt and the other quite the easiest to prepare of many of the silver salts. Preparing the double cyanide of silver is not considered a very difficult operation, but will require a little more attention than in preparing the silver chloride. Some operators form the cyanide of silver by generating hydrocyanic acid through a solution of silver nitrate as long as a precipitate is formed. By this method a slightly purer salt can be obtained than by the regular method of precipitation. The fumes are very dangerous to inhale in preparing the silver in this manner. In making the double cyanide of silver there are a few points of importance worthy of mentioning. One in particular is watching the neutral point. In dissolving the metallic silver it is necessary to use a perfectly clean nitric acid of commercial strength, etc. A great many operators, in fact all of the text and chemistry books, advise us to use about one-half water when making or cutting down silver. I beg the privilege to state that when cutting down silver I never use any water whatsoever. The way that I have found to be very satisfactory is to take the amount of silver we wish to dissolve, depending on the condition of the bath, the amount of work being plated, etc. Next, select a good sound jar, as heavy as possible to be had, one that will with convenience hold the combined contents of acid and silver and still have half of the gas for the action of silver and acid. The silver must be cut up into small pieces to obtain best results. The amount of acid that will be necessary to dissolve the silver should be put into a hot water bath and heated as hot as possible. After this has been accomplished add the metallic silver a little at a time. Ebullition will not be very great at first but will increase with the amount of silver that is added at a time. In dissolving silver in this manner it will be particularly necessary to have about half of the jar for the solution to rise in while in action. This is a very quick method of cutting down silver as the writer has cut 200 ounces in this manner in twenty minutes after the acid had become hot. If the solution in action should have a desire to boil over all that will be required will be to add a little cold water, which will check the action. After the silver has been dissolved add about 8 or 10 gallons of water, boiled or filtered, but necessary to be distilled. This is the reduced silver nitrate solution. In preparing the double cyanide of silver prepare a very concentrated solution of KCN and add to the above mentioned solution enough to throw the silver down as a white precipitate, resembling silver chloride somewhat but with this difference in preparing, that when the silver is precipitated with HCl or $NaCl$ an excess of either will do no harm, but if any excess of KCN should be added to the silver, as silver cyanide, the silver will be redissolved. Therefore it is up to the operator to watch the neutral point. That is, when all the silver is precipitated, then to

stop adding the K C N solution. Here it is very easy to commit one or two errors. First, to not decompose all of the silver nitrate or redissolve some of the precipitated silver cyanide by adding an excess of potassium cyanide solution. I believe that it is universally known that these various salts are very insoluble in water. Therefore we can pour or syphon off the water above the settled silver cyanide; by repeating the operations a few times we can free the cyanide of silver from any chemical salts that are not only unnecessary but detrimental to a plating solution. After sufficient washing of the precipitated cyanide of silver enough concentrated K C N solution should be added to just redissolve it. The solution must be well stirred while adding the K C N solution; after the silver cyanide is all dissolved add a little K C N to act as free cyanide. The chemical action which takes place in the solution is, the silver combines with the cyanide forming cyanide of silver the freed nitric acid uniting with the potash of K C N forming potassium nitrate. In preparing the chloride of silver the same method of cutting down the silver is used as described for the double cyanide of silver excepting that it is necessary to precipitate with hydrochloric acid or common salt, sodium chloride. The common salt is much to be desired, or preferred rather, for precipitating the silver nitrate. Some electro platers in preparing the silver chloride will add the natural salt in its granular form to the silver nitrate solution, but this is not the correct way of doing it from the experience that I have had with preparing this silver salt. The best method that I have found is to thoroughly dissolve all of the grain salt in cold water, then when adding the salt solution to silver nitrate solution there can be no chance of any of grain salt to enter the pockets or sell of the precipitated silver chloride. In adding the salt well dissolved it not only makes washing of the silver chloride easier and quicker but the final results will be better. If the grain salt should be added to the silver nitrate solution it will be with great difficulty that all of the salt can be washed out of the solution. Therefore another foreign salt will be added to the plating bath. After several washings the silver chloride will be ready to add to the plating bath direct. With the free cyanide in the plating solution the silver chloride will soon dissolve in the solution. If hot water should be added to the nitrate of silver solution and salt it will have a tendency to crystallize the silver chloride and will require more K C N to dissolve it. By using cold or lukewarm water a more soluble silver chloride will be obtained. In washing the silver chloride at times will turn dark and resemble mud. Silver chloride in this condition as far as I have observed has no material effect on the working conditions of the silver depositing bath.

Taking all of the different circumstances combined and reduced to three will be all that is necessary to produce the desired results. First, have your silver solution free from acid and salt; second, the proper regulating of the current; and third, a little judgment on the part of the operator while operating the solution.

*Chicago Branch.

Casket Hardware

BY J. E. YOUNGER

Foreman Plater Elgin Silver Plate Co.

IN this short article I will endeavor to present a few things in connection with the manufacturing of Casket Hardware.

The most extensively used metal for this class of goods is known as the Antimonial Lead Alloy, consisting of 87% Lead and 13% Antimony. Although there are some variations in this alloy, it is generally conceded that the 87-13 alloy gives very satisfactory results. It is with great infrequency that we find published detailed articles pertaining to the coloring and plating of soft metal, and I believe I am justified in taking the liberty to state that the man that is plating this metal continually, day after day, in quantities, is the man that is in a position to comprehend some of the little, peculiar and troublesome characteristics of this alloy. In handling soft metal the utmost care must be exercised at all times, especially if the metal has been polished to a surface, as the surface is very easily scratched, and if handled to any extent, will leave finger marks, etc.

To start the different processes in connection with line of goods, I will attempt to proceed with the casting, frequently termed molding. The molds are composed of a suitable Bronze Alloy and generally made in halves; one-half of the mold is held up right and fastened to a frame or holder; the other half of the mold has a handle attached so it will be convenient for the operator to open and close the mold. The molds, in order to produce satisfactory results, should be polished smooth, but not necessarily bright. There are a number of methods of preparing the molds for receiving the metal; the method most generally adopted is termed the smoked surface method. In preparing the molds, the molds are taken from their respective place of keeping and are next subjected to a slow heat. The object in heating the mold is to expel all traces of moisture as it is particularly necessary that the mold should be warm and absolutely free from moisture before a perfect adhesive deposit of smoke can be obtained. The most convenient and generally adopted method of smoking the mold is best accomplished with an ordinary kerosene torch. The mold held over the torch for a few seconds will receive a deposit of smoke. This deposit should be perfectly uniform, but not necessarily heavy if a first-class casting is desired. The molds are next set up in their proper position for the operator to proceed. Considerable care must be exercised in starting the mold as the smoked surface of the mold is very sensitive and very easily destroyed. The operator draws with a small hand ladle a sufficient amount of metal from his pot of hot metal to fill the mold. Before pouring the hot metal into the mold, it is particularly necessary to chill the ladle of hot metal;

the object in cooling the metal is to set the smoked surface; should the hot metal be poured into the mold the smoked surface would be destroyed—then the operator would have to resort to the smoking operation again. It is possible to operate some molds without smoking, depending entirely on the design of the mold. Cold water poured in some molds has a tendency to form a water scale which enables the operator to produce satisfactory results. One of the principal features in connection with casting this alloy is to keep the heat of the mold below a certain temperature. If the mold should get too hot, it will be impossible to produce a satisfactory casting, as the metal will not set or harden. All that is required to regulate the temperature of the mold is a pail of cold water and by using a swab dipped in cold water. Some molds, if not properly smoked, have a tendency to burn the castings in spots. A little cold water applied to the exterior of the mold on these spots will suffice to remedy this. The castings are next transported to the trimming and inspection room. Here the gates are broken off, properly trimmed, all imperfect and inferior castings are returned to the melting pots to be re-casted. The castings are next counted out in suitable quantities and delivered to the polishing department. Here the castings are cut down on a cloth wheel with white diamond or some other cutting compound. They are next colored up with crocus and a sheepskin wheel. This mode of polishing is all that is required, as a very satisfactory color can be obtained. Very little of this alloy is sand-buffed to-day, although a few years ago it was generally customary to sand-buff all of this class of goods. The castings are now shaded with tissue paper. All work that contains any polishing compound or are not properly cut down are returned to the polisher that did the work, as each man's work is kept separate, and when a job is rejected there can be no cause for argument.

The polished castings are now delivered to the plating room in dozen or gross lots depending on the net quantities. The work is racked upon suitable racks, some racks holding six pieces and others as high as one hundred, depending entirely on the size and design. The racks are made of iron and can be used for an indefinite length of time. When a heavy deposit has formed they must be stripped off. The work is now suspended in the potash.

There is a great diversion of opinion in regards to the cleaning of this metal. I am taking the liberty to state that I have tried a number of cleaners and would-be cleaners, but considering the amount of metal and the value of the alloy, it leaves me satisfactorily convinced that the common 3X Soda and Lye gives me the best results. My method of working and maintaining the potash bath is to dissolve a quantity of potash in warm water, not boiling, bringing up solution to stand about 20 Deg. B.; then draw off enough regular potash, enough to stand about 60 B. In doing this, it is necessary to be careful so as not to disturb the sediment. Therefore you have a perfect, clean potash bath. The potash kettles that I am using

have a capacity from 8 to 16 racks. The racks are put in and taken out of the pot consecutively.

The work is suspended in the cleaner a few minutes. They are then properly rinsed, brushed with a soft brush and hung in the nickel bath. The nickel baths are one hundred gallons copper.

My experience with this alloy, day after day, has given me the opportunity to learn that the double nickel solution gives me all that is required with the ordinary addition of conducting salts, etc. The nickel baths are fitted up exactly the same throughout with same amount of anode surface, 5 Deg. Be. with $2\frac{1}{2}$ - $2\frac{3}{4}$ volts pressure. Therefore, by using these baths as near uniform as possible I believe a plater can maintain his solutions in better condition and the net results will be far greater.

As this class of work is not nickel buffed, it is not necessary to give a heavy nickel deposit, although heavy enough, and at the same time, bright enough, to assure a good deposit for the next plating, silver. The silver solutions that I am at present using are all fitted up with iron cathode bar and under surface anode bar and are capable of handling same amount of work as the nickel bath.

I think it is a universal fact that in order to obtain satisfactory results in silver plating, all work must be struck up in a silver strike. My method of producing large quantities of silver plated goods is to keep all the tubs filled to their greatest capacity at all times. Proceeding with the silver plating two — are taken from the nickel bath, properly rinsed and hung in the silver strike after the work is properly struck, which requires a minute or so, depending on the cathode surface. They are moved along, hung in silver solution No. 1 until the next two racks are ready to be taken out of the strike, and so on until both silver baths are filled up. This requires from 5 to 15 minutes, depending entirely on the article and finish desired. From actual experience with the alloy, I find that running the silver strike at 5 deg. Be. with from 3-4 volts and silver baths 6 deg. Be to 7 deg. Be with $2\frac{1}{2}$ -3 volts and the correct metallic contents, will give all that is required in a pure white deposit. A great percentage of casket hardware is put on the market in the bright silver finish and must necessarily be silver buffed in order that the silver buffers may handle the work without a great deal of cutting down. The plating is supposed to be turned out of plating rooms as bright as possible, therefore some brightening agent must be used, such as Carbon Bisulphide or Benzole, but consensus of opinion greatly favors the carbon brightener. As little as possible of this should be used, as it is very powerful; a little in excess will cause no immediate harm or damage, but if too great an amount should be added, it will cause considerable trouble to plater and it will be impossible to produce a bright finish.

Extreme care must be exercised when using carbon for a brightener. I might also mention that it is not necessary to agitate all of the work in the silver baths in order to produce a bright

plating, but increasing the power and agitating the work for instance, the racks that are ready to come out of silver bath are moved very briskly back and forth for a few moments will give a much brighter surface than if the power had been left at regular point and work not agitated.

After the work has been sufficiently plated they are rinsed in silver rinse, then in perfectly clear cold water, then in hot water from four to five minutes. The work is then swung off and placed in steam heaters for fifteen minutes.

*Chicago Branch.

Determination of Free Cyanide in Cyanide Copper and Brass Baths

J. T. BURT-GERRANS AND G. O. MORRISON.

IT is well known to all platers that, after being used for some time, brass baths and alkaline copper baths frequently require the addition of fresh potassium cyanide to keep them in working order. If the amount of the addition is not to be determined by mere guess work, some analytical method of determining the cyanide in the bath must be adopted. Many such have been proposed.

For the determination of the content of cyanide in a pure solution of an alkaline cyanide (such as potassium or sodium cyanide) Liebig¹ used a standard solution of silver nitrate and measured the volume required to produce a permanent precipitate in a known volume of the solution to be analyzed (Method I). To make the end point more distinct he later proposed the addition of a little common salt as an indicator (Method II). J. S. McArthur and J. E. Clennell² substituted potassium iodide for the common salt (Method III). Carl Mohr³ employed an ammoniacal copper sulphate solution of known composition instead of the silver nitrate, adding it to a measured volume of the solution to be analyzed until the purple color ceased to be discharged (Method IV). In a recent number of the *Brass World*, E. S. Sperry⁴ proposed the use of a neutral solution of zinc nitrate as a standard solution, adding it until a permanent precipitate was formed (Method V).

All these methods give satisfactory results when the solution to be analyzed contains only potassium cyanide and water. If copper

¹ Liebig *Anal. der Chem. u Pharm.*, 77, 102; *Fresenius Quant. Chem. Anal.*, I, p. 549.

² J. E. Clennell. *Chemistry of the Cyanides*, p. 8.

³ F. Mohr *Titrimethode*, p. 421.

⁴ *Brass World*, May, 1913.

or zinc salts be present, the amount of cyanide found by the analysis is less than the amount of potassium cyanide taken in making up the solution for analysis; hence a distinction has arisen between "free" cyanide, as found by analysis, and "combined" cyanide united with zinc or copper to form complex salts.

For the determination of free cyanide in copper and brass baths, Langbein⁵ describes Method II, but recommends that "only about 60% of the discrepancy of free potassium cyanide" (as determined by Method II) "should be replaced by pure potassium cyanide"; and states that "analytical method alone is not sufficient for maintaining entirely constant baths containing potassium cyanide; and practical experience and a good faculty of observation are required if the results of analyses are to be used for the correction of the baths."

To a chemist, the conclusion to be drawn from this frank statement seems to be that the analytical methods needs improvement, since the only object in making the analysis is to obtain exact data for correcting the bath. As it seemed, moreover, for a chemical reason, very likely that the methods I to V would not give accurate or concordant results in cyanide solutions containing ammonia, alkaline, bisulphites and the other salts commonly met with in copper and brass baths, a number of experiments were undertaken with a pure solution of potassium cyanide containing no copper or zinc. A measured volume of this solution was taken in each case and the cyanide determined by each of the five methods mentioned above, but before making the analysis a measured amount of some common alkali or salt was added to the cyanide solution.

The results of the experiments are given in tabular form. Column one gives the name of the salt or alkali added, column two the amount used expressed in⁶ grams per 100 cc of the potassium cyanide solution taken for analysis.

The numbers in the other columns give the number of grams of potassium cyanide in 100 cc of the potassium cyanide solution as found by the five methods of analysis used. The amount of potassium cyanide actually present in the solution was in every case exactly 1.00 grams per 100 cc (1 lb. per 10 imperial gallons). Examination of the table shows that all five methods give the true value, viz., 1.00, when nothing but potassium cyanide is present in the solution; but that anywhere from 3.7 to 0.9 grams of potassium cyanide per 100 cc were "found" by the different analytical methods when alkalies or salts were present. Now alkalies and salts are generally, if not always, present in commercial baths.

⁵ Langbein, *Electro Deposition of Metals*, p. 336.

⁶ One gram per 100 cc is the same as 1 lb. av. per 10 imperial gallons (12.01 U. S. gallons).

Substance Added		Silver Nitrate			Zinc Nitrate	Ammonia- cal Copper Sulphate
Name	g. per 100 cc of Pot. cyan. sol.	I	II	III	IV	V
None	0.0	1.00	1.00	1.00	1.00	1.00
Potassium hydrate.....	*	1.01	1.01	1.00	2.71	0.98
Potassium carbonate.....	2.0	1.00	1.00	1.00	1.58	0.98
Potassium carbonate.....	4.0	1.00	1.00	1.00	1.75	0.91
Ammonia Sol. (Spl. gr.)=0.90	3.6	1.11	1.12	1.00	2.56	0.98
Ammonia Sol. (Spl. gr.)=0.90	7.2	1.31	1.28	1.00	3.72	0.98
Sodium thiosulphate.....	2.0	1.59	1.59	1.10	1.07	1.06
Sodium thiosulphate.....	4.0	2.35	2.35	1.18	1.45	1.14
Sodium bisulphite.....	0.4	0.99	1.00	0.95	0.72	1.15
Sodium carbonate.....	2.0	1.00	1.00	1.00	1.62	0.97
Sodium sulphate.....	2.0	1.00	1.00	1.00	1.06	1.00
Sodium acetate.....	2.0	1.01	1.01	1.00	1.08	0.97
Sodium chloride.....	2.0	1.00	1.00	0.99	1.02	0.99
Sodium phosphate.....	2.0	1.02	1.02	1.00	1.12	1.00
Rochelle salts.....	2.0	1.00	1.00	1.00	1.39	0.99
Sodium bisulphite.....	0.4 } 2.0 } 0.4 } 0.4 }	1.00	1.00	0.99	1.60	1.08
Sodium carbonate.....	2.0 }	1.03	1.02	1.00	1.25	1.21
Sodium bisulphite.....	0.4 }					
Sodium carbonate.....	0.4 }					
Ammonium nitrate.....	2.0	0.98	0.98	0.98	1.00	0.93
Ammonium chloride.....	2.0	0.97	0.96	0.98	0.97	0.91
Ammonium carbonate.....	2.0	0.97	0.96	0.97	1.28	0.89
Ammonium oxalate.....	1.0	0.99	1.00	0.99	1.02	0.96
Arsenious acid.....	0.1	1.00	1.00	1.00	1.03	1.00
Potassium Ferro. cyanide.....	2.0	1.09	1.09	1.00	1.01	br. ppte.
Amm. sulpho cyanate.....	2.0	1.00	1.00	0.99	1.04	0.92

* Concentration not known.

Comparison of the five methods shows that number III, using silver nitrate and potassium iodide, is the most reliable; results obtained by this method come within a few per cent. of the truth in every case except when sodium thiosulphate ("hypo") is present; after hypo, ammonium salts interfere most, but free ammonia, alkalis, carbonates, bisulphates and the other salts do not hurt. Detailed instructions for the employment of this method are therefore appended.

A number of experiments have been carried out by the writers in conjunction with the members of this society in the laboratory of the Toronto branch, in the Central Technical School here, with a view to adapting this method to the determination of free cyanide and of zinc in brass baths. The results have been most encouraging and have enabled us to bring several brass baths which would not place into a condition which gave very good deposits. When the investigation is completed we hope to be able to report *details of the determination of free cyanide by the use of silver nitrate and potassium iodide as indicated.*

THE APPARATUS NEEDED.

The apparatus necessary is simple, all that is required being a one-litre measuring flask, two 50cc burettes, a 10cc measuring cylinder, a 10cc pipette, a balance sensitive to one milligram with 15 grams load and a few 300cc beakers. The end-points of the titrations are sharp and distinct (in contrast to those of the zinc nitrate and ammoniacal copper methods) and with a little practice duplicate determinations of free cyanide may be made in 20 minutes or half an hour.

SOLUTIONS USED IN THE ANALYSIS.

Solution of Silver Nitrate—Made by dissolving 13.037 grams of crystallized silver nitrate in distilled water in the litre flask, and making the volume up to one litre with distilled water. This is the standard solution and must be made up carefully. The crystals must be weighed accurately, distilled water used, the volume made up to exactly one litre and the whole well mixed by shaking. When properly made it is perfectly clear and colorless; it should be kept in a glass stoppered bottle.

Solution of Potassium Iodide—Made by dissolving 10 grams of potassium iodide in enough water to make one litre.

Solution of Sodium Hydrate—Made by dissolving 200 grams of stick caustic soda in enough water to make one litre.

Solution of Hydrochloric Acid—Made by diluting 10cc of pure concentrated hydrochloric acid of specific gravity 1.12 to one litre.

Solution of Potassium Ferrocyanide—Made by dissolving 37 grams of the crystallized salt in enough water to make one litre.

Solution of Phenol-Phthalein—Made by dissolving one gram in 100cc of pure alcohol and adding 100cc of water.

None of these solutions, except the silver nitrate solution, need be made up with extreme accuracy.

DETERMINATION OF FREE CYANIDE IN CYANIDE COPPER BATHS.

In the case of a cyanide copper bath, known not to contain zinc, the procedure is as follows: By means of the pipette measure 10cc of the bath into a beaker, add about 5cc of the potassium iodide solution; then add the standard silver nitrate solution from a burette until one drop causes the appearance of a yellowish milkiness which does not disappear on stirring. The number of cc of silver nitrate solution used, divided by 10, gives the number of grams of free cyanide in 100cc of the bath, that is, the number of pounds of free cyanide in 10 imperial gallons (12.01 U. S. gallons) of the bath.

DETERMINATION OF FREE CYANIDE IN BRASS BATHS.

When zinc is present, as in brass baths, the analysis must be carried out in three steps:

Step I.—Pipette 10cc of the bath into a beaker; add 5cc of the

potassium iodide solution and 5cc of the sodium hydrate solution; then add silver nitrate solution, from the burette, until one drop gives the permanent yellowish turbidity.

Step II.—Another portion of 10cc of the bath is pipetted into a beaker and one or two cc of the potassium ferrocyanide solution added. Slightly more than the amount of silver nitrate solution needed in Step I is added at once from the burette. A few drops of the phenol-phthalein solution are then added, which causes the milky liquid to turn pink. Now, without filtering, the hydrochloric acid solution is added from a burette until the pink color just disappears; this step shows how much acid is needed to make the bath neutral.

Step III.—A third 10cc portion of the bath is pipetted into a beaker and the same amount of hydrochloric acid as was used in Step II is gradually added from the burette with stirring. About 5cc of the potassium iodide solution is poured in from the measuring cylinder or added from a pipette, and then the standard silver nitrate solution from its burette, until the milkiness appears and remains permanent after stirring and allowing to stand for half a minute. The number of cc of silver nitrate solution divided by 10 gives the number of pounds of free cyanide in 10 imperial gallons (12.01 U. S. gallons) of the bath.

Example.—Suppose that in Step III 12.5cc of silver nitrate solution were used, then there are $12.5/10=1.25$ lbs. of free cyanide in 10 imperial gallons (12.01 U. S. gallons) of the bath.

NOTES.

If, on the addition of silver nitrate in Step I, a black or gray precipitate appears before the yellowish turbidity, the analysis must be begun over again with a fresh portion of the bath and less caustic soda and more potassium iodide must be used. So far we have observed this black precipitate only in brass baths which were known to contain sodium bisulphite and arsenic.

If the bath is neutral to litmus paper (this will not occur with old baths) Steps I and II may be omitted, and the analysis begun at Step III; it is safer, however, to go through the whole procedure.

In conclusion we wish to express our thanks to Dr. W. Lash Miller for the useful suggestions in the carrying out of this investigation and for editing this paper.

The foregoing investigations were conducted by the members of the Toronto Branch and were written up and formed by Messrs. J. T. Burt-Gerrans and G. O. Morrison, of the Toronto University staff.

