AMERICAN ELECTRO-PLATERS SOCIETY

(An Educational Society)

Chartered 1909

MONTHLY REVIEW

OCTOBER, 1915

INDEX

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I shall pass through this world but once. Any good thing, therefore, that I can do, or any kindness that I can show to any human being, let me do it now. Let me neither defer nor neglect it, for I shall not pass this way again.—*Amiel.*

MONTHLY REVIEW

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Vol. 2 OCTOBER No. 5

EDITORIALS

KEEP ON SMILING.

Ella Wheeler Wilcox may be all right as a poetess, but we think she would make a bum editor for our Monthly Review, we can't say of the plater that, the man worth while, is the man who will smile when everything goes dead wrong.

The only man we ever heard of who would do that was Mark Tapley, one of Dickens' character, and he was fictitious. We don't like it a dern bit when anything goes wrong in the plating department, and if everything would go wrong, we wouldn't smile again until we got everything going right. Even Fred Liscomb didn't always smile, when he was a plater-foreman. Not that we can't look trouble in the face and laugh at him.

When I was a little boy I used to look upon the whole world as one big joke, made just to amuse me. I have never entirely gotten over that idea. But that solution that won't give results, or that finish that we can't exactly get, that serious perplexing plating trouble that demands your earnest concentrated endeavor.

How we can smile when we overcome it.

The man worth while has a hard taskmaster, he has got to please his own self before he can smile, when he knows that he has done his level best, no fudging, the best he is capable of, then he can surely smile, and the smile that comes from the ability to look the whole world in the face, will never wear off.

We have heard platers say years ago, I get paid for what I know. We never hear things like that now, we would all be glad if we got paid for what we don't know.

Hence the American Electro-Platers' Society. A glance at what the Branches Are Doing will show that collectively and individually we have a right to smile. Let us keep on smiling.

H. J. RICHARDS.

WHAT THE PLATER OUGHT TO KNOW—Continued.

THE METRIC SYSTEM. By F. A. SHEPHERD.

It would seem after going over large quantities of literature and also following the arguments in several trade papers that the principal objection to the Metric System is based on one of three things namely: Ignorance or not able to multiply or divide using the decimal system; Hostility owing to the fact of not knowing its origin; or, Finally owing to the large amount of money that is invested in machinery and implements that the graduated to the inch.

The last is the only cause of opposition that has any merit to it and it is also a fact that the longer the Metric System is put off the more it is going to cost and it is a certainty that if the United States is going to get new outlets for trade and development of the foreign markets that were formerly supplied by the Nations at war, and especially Europe's old customers who were educated to the Metric System, then the United States manufacturers will have to adopt the Metrical System or lose out, as there would be as much confusion for those people to try and adapt their simple systems to our complicated systems, as there is for us to adopt the Metric System to our every day requirements.

Silvanus Thompson's Elementary Lessons in Electricity and Magnetism is a recognized text book and accepted also among Scientific people as such has this to say in regard to fundamental units, Paragraph No. 280.

"All physical qualities, such as force, velocity, etc., can be expressed in terms of the three fundamental quantities; Length, Mass, and Time. Each of these quantities must be measured in terms of its own units.

"The system of units, adopted by almost universal consent, and used throughout these lessons, is the so-called, 'Centimetre-Gramme-Second,' system in which the fundamental units are:

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The Gramme as the unit of Mass (weight);
The Second as the unit of Time."

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The object of this article is to give a clear conception of the Metric System and one that is comprehensive, with the object of having this system adopted by the Supreme Society of the American Electro-Platers' Society as a Standard. Aside from other reasons to follow its acceptance will make the other studies less complicated than they are at present, we have often heard reference to Langbein's book such as this, "Langbein's book is all right, but, "etc. The reason for this is, the units there, which were not understood, mostly.

Some people who object do not fully look up the system and its relation to the other units, others who do look them up (who do not purposely misconstrue) and still object may see a different value attributed to the same unit somewhere else, as an instance take the gallon.

In England the Imperial gallon is equivalent to a volume of 277.46 cubic inches.

In the United States the gallon is equivalent to a volume of 231 cubic inches.

It is plainly evident that the English gallon having a volume of .20032 cubic inch more than ours (about a fifth again as much) and both are called by the same name the metric equivalent for the gallon would be different, etc.

Still there are those who point out the variation between the two and say the Metric System varies and is inconsistent. This is only one instance.

A PARALLEL RELATION AND COMPARISON OF METRIC SYSTEM, SIMPLICITY.

A Nickel solution to have a volume of 6 ft.x3 ft.x4 ft. to be made up of single salts with four ounces of metal per gallon. How many gallons, and how much will the completed solution weigh.

This would be approximately (72 in.) 1,828803 metresx(36 in.) .914405 metresx(48 in.) 1.219202 metres.

72x36x48=124416 cubic inches.
124416
231
=538.59 gallons.
A gallon weighs 8.355 pounds.
538.59x8.355=4,499.91945 pounds weight of water.
Four ounces per gallon would be
4x538.59
16
=134.65 lbs. metal. Nii Single salts=20.91%Ni.
134.65x100
20.91
=about 644 pounds salts.

538.59 Gallons.
4,499.91945 pounds wt. of water.

644. pounds wt. of salts.
5,143.919 pounds wt. solution.

COMPARING THE TWO.

2,038.7462 litres.
2,038,746,24 cc. or g. wt. of water
290,914.818 gms. wt. of salts.
2,329,561.058 gms total weight.
.0022046 gms per ounce.
5135.7503084668 Adv. pounds.

Which only shows a difference of 8.17 lbs. in a total weight of over 5,000 which is close enough when it is remembered that decimal equivalents were used and some of the figures only approximate.

1.828803x.914405x1.219202=2.03874624 cubic metres.

**A cubice metre weighs a Metric Ton. Simply by moving the decimal point will now give the weight and volume as a thousand litres are a ton;

2.03874624x1000 (move decimal 3 places)=2,038.74624=cubic dcm's, litres, or Kgs.

2,038.74624x1000 (move decimal)=2,038,746.24 cu. cm. (cc) or grams (g).**

Four ounces per gallon would be about .029885 grams per cc.

.029885x100
20.91
=.1427 gms per cubic cm.

One million cubic centimetres equal one Metric ton, so the operation inclosed with stars above can be done by moving decimal six places.

2,038,746.24 ccx.1427 g.=wt. in gms. or,
290,9914.818448 gms. weight of salts.
2,329561.058 gms as total wt. lcc=1 g.

The Metric System would be advantageous for us to use in relation to our analysis of the different solutions, and the relation they bear to eah other. This don't mean that it is absolutely necessary for us to have scales weighing in grams and kilogrammes for large quantities, etc., or that we have to use the whole system as it has been defined in the fore part of this article.

Take the measurement of the tank or solution in the ordinary way that you are used to, instead of figuring out to gallons from cubic feet though, multiply the cubic feet by 28.3137 this will give you the number of litres in the tank, and, as the litre is 1000 cubic centimetres, then by moving the decimal point three places to the right (multiply by 1000) you will have the answer in cc. or the weight in grammes as one cubic centimetre weighs a gram.

If you take your measurement in inches, then after getting cubic inches multiply by .0163853 the answer will be in litres, as above, move decimal for cc.

If your formula calls for so many gramms per cubic centimetre, or per litre, you are now in condition to make up your solution by the formula.

If you wish to analyze your solution all you have to do is to take out any number of cubic centimetres, measured by pipette or graduate, as a sample analyze it and find out the amount of substance required for the amount of the sample taken, after this is determined then divide the total amount of your solution by the amount taken to test, and multiply the total amount required for sample tested, by the answer, this will give the total amount required for all.

Suppose you have taken one cubic centimetre and found it required any number of gramms per cubic centimetre multiply the amount in gramms per cc by 133.98 the answer will be ounces required per gallon.

Suppose your formula for a nickel solution calls for two (2) ounces of Magnessium Sulphate per gallon. Two ounces would be 2/16 of a pound; divide the two (placing the decimal after it and adding five ciphers) by sixteen, the answer will be the decimal parts (or fraction) of a pound. Now as there are 454 grams in an advoirdupois pound multiply the result by 454 and the answer will be grams per gallon. As one gallon contains (U. S.) 3.785 litres then this divided into gms per gal. will give grams per litre, moving the decimal point three places to the left will be the grams per cubic centimetre. You are now in a position to analyze one cubic centimetre or any number and find out the amount required and replenish your solution accordingly. By reversing the operation you are able to change gramms per cc to ozs per gallon, etc. It is not at all necessary to add five ciphers unless the number will carry over five decimal places. If the decimal is to be moved three places to the left and there are only one or two figures it is necessary to fill those places in with ciphers.

2/16 is one eighth, one eighth is 125; 125x75;=56.75; 56.75 divided by 3.785 equals 14.9933-plus; moving the decimal three places to the left and adding the cipher to fill, gives .0149933-g. per cc. equals two ozs. per gallon.

From the above then it will be understood how these figures are obtained and to avoid the mathematics as much as possible and make it simpler then just take the figure 133.98 (or 134.) using it as the factor then to change from grams per cc to ozs. per gal. use it to multiply; to change ounces per gallon to gramms per cubic centimetre then use it to divide.

As this paper would be too long if I carried it out as I had intended to, that is, explanation of the Chemistry in the same way to make it clear, then I will close it with just a little explanation of the Normal solutions and the relation of the Atomic Weights to them. You can get tables of atomic weights in any text book or probably they may be published in the bulletin.

A STANDARD NORMAL SOLUTION IS GRAM ATOMIC WEIGHT DIVIDED BY THE VALENCE.

A Standard Normal Solution though is one used by Chemists and is made up in such a way that its relation to any other solution is definite and relative, they are made by using the table of atomic weights and taking Hydrogen as the STANDARD. Therefore a standard normal solution is a solution made up in such a way that one litre (1000 cc) will contain the gram Molecular Weight of the Hydrogen or of its equivalent. This means that the figures in the column under (H) or that column representing the relative weight of the Elements in relation to an equal volume of Hydrogen. REPRESENTING HYDROGEN AS (1) ONE GRAM, then an EQUAL VOLUME OF HYDROGEN would weigh ONE SIXTEENTH AS MUCH AS AN EQUAL VOLUME OF OXYGEN, therefore the atomic weight of OXYGEN is (16) sixteen, CHLORINE 35.5 SILVER (Ag) 107.88, commonly taken as 108, etc. The symbol for silver is Ag, etc., this is the chemist's short hand or abbreviation. SULPHURIC ACID HAS A GRAM MOLECULAR WEIGHT (taking the atomic weights in grams) of (H_2) or two times 1 plus one of (S) sulphur 32. plus (O_4) four of oxygen 4x16 giving a total of 2 plus 32 plus 64 or a total molecular weight of 98; but as there are two of Hydrogen and a Normal solution only contains one, then dividing by two, we get 49 and weighing out 49 grams of sulphuric acid and diluting it to exactly one litre we have 49 g in 1000 cc and one cc contains .049 grams of sulphuric acid and will exactly neutralize any normal solution of alkali. Any normal solution of alkali will exactly neutralize, exactly the same amount of any normal acid.

GENTLEMEN THIS ARTICLE WAS PREPARED WITH THE HOPE THAT WE WOULD ADOPT THESE SYSTEMS AS STANDARD AND ALL OF US USE THEM, SOME OF US KNOW MORE ABOUT IT THAN OTHERS, again, PROBABLY SOME OF US HAVE LEARNED OR NOW UNDERSTAND THEM BETTER THAN WE DID BEFORE. IT WAS QUITE A JOB FOR ME TO PREPARE IT AS I HAD TO FIGURE NEARLY ALL OF IT OUT TO MAKE IT CLEAR AND IN DOING SO I LEARNED SOMETHING. GO TO IT AND PASS IT ALONG.

I have given the figures used to obtain results in the calculations so that in case of error (which I doubt) it is immaterial.

MOTION PLATING.

Read at the Dayton Convention by H. J. RICHARDS.

The first copy of the Quarterly Review that I received, the January, 1914 number, contained an article from the pen of Mr. R. W. Davenport, entitled The Why of Electro Plating, and one sentence at the close of that fine paper, I copy entire, because it explains clearly the why of Motion Plating. Mr. Davenport says it is probably clear to you that the effect of increased voltage is to increase the current density at the electrodes, and that burning is caused by the inability of the current to bring fresh nickel to the cathode as fast as it is removed, agitating the solution, enables us to use a higher voltage and sometimes proves economical.

Two years of constant use of a motion plating aparatus at the Koken Barbers Supply Co., plating a great number of and variety of castings daily, has yet to reveal a single case in which it did not prove economical.

In the Review of December, 1914, Dr. Watts in his paper on Some Observations of Nickel Plating Solutions, says: There are several methods of making a dilute solution do the work of a concentrated one, to circulate or stir the solution or to move the object, any process that will break up the film or dilute solution formed around the object, and supply metal as fast as it is needed for deposition. Professor Watts adds circulation and stirring of the solution has long been used in the electrolytic refining of metals, but because of stirring up the sediment, always present in plating tanks or possibly some other reasons, these methods have not come into regular use in commercial plating. Think of it, long been successfully used in electrolytic metal refining, but too much trouble for us to adopt to plating conditions.

Now first as to sediment. I run an ordinary double salt solution four months without filtering or cleaning out in conjunction with motion plating and have never had a single batch of work injured by sediment. Sediment in a plating solution is not a necessity, but a fault and should be corrected periodically My motion mechanism on a 500 gallon tank takes less than ¼ horse power to operate, and we are getting a deposit on the work in 20 minutes that it takes an hour and a quarter to produce by still plating.

A 500 gallon tank doing the work of 1500 gallons. There is another reason for the low voltage we are compelled to use in still plating, like all forces, electricity always seeks and finds the path of least resistance, it always finds the short cut, so the point or part of the object which sticks out nearest to the anode, is the part that gets burnt. This in many cases compels the use of more resistance and considerably lengthens the time of deposition.

If by a motion you continually change the relative positions of cathode and anode, this condition will cease to exist.

Now I will come to one more fault in still plating, the lack of uniformity.

This is mostly caused by an unequal distribution of the anodes and poor contact with cathode rod. I find with motion plating I get unfailing uniformity, the relation of each cathode to each anode being identical, and there being just sufficient pull on the cathode carriers to insure a good contact. A swinging or pendulum motion is incorrect, as all parts of the cathode do not get the same motion and the parts getting the least motion would probably burn. A sediment stirring motion is incorrect as we can never entirely get rid of sediment. The motion therefore should continually move the cathode into new solution, change relative position of cathode and anode, and should be adapted to a wide range of work. I take the current direct from the bus bars at the voltage found suitable using no rheostats, no resistance.

Resistance is exactly what its name implies, and is always a waste. The cutting down of the voltage at the tanks with a rheostat, with its subsequent loss of amperage, can be likened to a man driving an automobile through a village, and reducing his speed to the village requirements entirely by the use of a brake.

I do not touch on any contention as to the composition of the solution, any anodes, any temperature which are successful in still plating, will invariably and infallibly be found still more successful in motion plating.

SHINE JUST WHERE YOU ARE.

Don't waste your time in longing
  For bright impossible things;
Don't sit supinely yearning
  For the swiftness of angel's wings.
Don't spurn to be a rushlight
  Because you are not a star,
But brighten some bit of darkness
  By shining just where you are.
There is need of the tiniest candle
  As well as the garish sun;
The humblest deed is ennobled
  When it is worthily done:
You may never be called to brighten
  The darkened regions afar;
So fill, for the day, your mission
  By shining just where you are.

—John Hay.

BRIGHT SILVER PLATING.

By Mr. Frank J. Burkhart of Cleveland Branch.

Speaking of silver solution for different classes of work where buffing or scratch brushing is entirely eliminated, I will refer to the bright silver solution this finish is known as the white or bright finish or commonly called white wash. To produce this deposit I use about 1¾ to 2 ounces of silver to the gallon, but enough free cyanide must be in existence or the work will not come out bright. The articles must also be well struck up in the silver strike at that or they will turn pink. Must also be perfectly clean before plating, time of deposit five minutes. To begin a day's work I first cut down my carbon in a solution of cyanide, then add carbon and heat the bulk until dissovled, then I add 2 to 3 ounces to my solution, which contains approximately 120 gallons. At times black sulphur spots appear on the work, but after an hour or so they disappear. I think that this is caused by not having enough free cyanide in the solution. You must regulate your carbon according to the output of your solution, as too much of it will upset same. It then needs more water and a little cyanide of silver and a rest. As to sodium carbonate in a bright silver solution, I think there is nothing that will beat it. Have turned out as high as 2000 and more pieces daily. This is a cheap finish for coffins, hardware, regalia work, souvenirs, cheap flat ware, etc. Where hand burnishing or buffing is relied on, work must run 12 to 15 minutes, is then fit for first class oxidizing or any finish you may choose.

Discussion on the Above Paper.

Mr. Henkle. I have seen work done this way that was put away for 12 years and only needed a cyanide dip to bring it up to its former finish, and I also found is very soft for oxidizing.

Mr. Hale. Do you keep up your solution from the anode?

Mr. Burkhardt. Very nearly so.

Mr. Hale. Do you make up a stock solution of silver-solution, sulphuric ether and bisulphide of carbon to keep your solution bright with?

Mr. Burkhardt, I have found that there is no life in a stock solution. I mix it up and use it at once, but I find that if I use the solution immediately after, sometimes the work has carbon spots on it.

Mr. Hale. That I think is caused by not having the carbon well dissolved. I always make up stock solution to last a month, and I also have carbon bisulphide in the strike and only strike the work 30 seconds, and plated it 1½ to 2 minutes, for a full bright finish, I used a small anode and large cathode and keep up my solution with cyanide of silver, I use about ½ fluid ounce of stock solution to each 5 dozen handles plated and found that the proper amount.

Mr. Henckle. The reason your solution runs out of metal is because you run too much work and current and not enough anodes.

I found since we use cyanide or silver, the solution maintains itself better than it did, using the chloride of silver. The solution I am using is over 25 years old, and does good work, and the work oxidizes well and even all over, generally speaking, but we make it a practice to dip the work in the liver of sulphur, the second time, after the first has been buffed, or it does not get the full black we want.

Mr. Hale. Do you use the same racks to oxidize your work that you use to plate with?

Mr. Henckle. We do not, we use others.

Mr. Hale. Well I used the same racks all around and did not find it made any difference, of course I took the black off before using for plating, again I use about ½ pound liver of sulphur per gallon, for my oxidizing solution.

Mr. Henckle. I use about the same perhaps a little more.

THE METALIZING OF WOOD.

By H. J. Ter Doest, Cleveland Branch.

As my experience in metalizing has been confined principally to wood, I will undertake to explain the method I follow, as I have prectically no rejections and do this work nearly every day. I have also done some plaster of paris pieces and they came out just as successful as the wood. You first take the wood after a good finish has been put on it and make provision for conducting wires and weights to hold it in solution, I use a long thin screweye for that purpose, which I put in place where it does no harm, after the work is plated, which in this particular case is just where they must be anyway.

You now give it two coats of lacquer to keep out the water, this lacquer is dipped on where it is possible as that is a faster as well as a better way, after the lacquer is hard you give it a very thin coat of varnish, one part copal varnish to three of turpentine, this is applied with a brush, any kind will do, as it will flow out smooth no matter how you put it on, if you do not put so much on that it will drip you next put on the bronze powder after letting the varnish dry for about one-half hour or until it is set, but still very sticky; but not so sticky that the bronze powder brush will stick to it. The bronze powder is put on with a camel or bear hair brush, and well brushed all over, so that there are no bare spots, as they will not cover when put in the solution.

The bronze powder must be of a kind that is made for that purpose, a very fine brick dust appearing kind, and sold under the various names of copper carbon bronze powder, copper lining bronze powder, finest copper plating bronze powder, etc.

After this you put on your wires very carefully, taking care not to scratch your work with same, and after thorough drying, you wash off the surplus bronze powder with water under a faucet or with a hose so as to get all over with a fair pressure of water, as on this depends largely the smoothness of your deposit, now pour over your work some silver dip solution, so as to whiten the copper bronze, look it over well for spots as they are now plainly seen, and should be touched up with a little varnish and bronze powder and again silver dip poured over the whole and if all is well hang in the duplex copper where if well done it should at once start to cover, radiating from the wires.

The thickness of deposit desired will determine how long to run them also the speed at which you can run them will be determined by the size of the article and the size of the solution also the distance from anode to cathode, the smaller the article the faster they can be run, by that I mean amperes per square foot. Also the more solution in relation to the work the faster you can run it, but the solution must be between the anode and cathode otherwise it does not count.

I generally run my work, which by the way, must be buffed to a high finish and nickel plated. About 9 hours for a deposit of 1/16 ounce per square inch, or approximately 24 amperes per square foot at ½ volt, and only plate about 1 square foot in about 70 gallons of solution and use a solution that contains at 19° Beaume 6 ounces of free sulphuric acid per gallon, the reason I use so much free acid is because I find that the more acid up to that point, the smoother the deposit, but you will find you cannot go any further as you will not get the deposit according to the electrochemical equivalents, and consequently deposit gas as well as copper thus making your deposit brittle as well as sticky, unless you use such a low current density that you would never get any work done.

This silver dip I speak of, is the regular made up by dissolving chloride or cyanide of silver in cyanide, and the reason for using this is twofold; 1st it leaves the work so that water will cover it uniformly all over, or in other words it cleans it. The second reason is; when you whiten your work it shows plainly if you have any bare spots.

The reason I say pour it over, is because, otherwise you will have trouble with air bubbles sticking to your work.

That there is a wide field for investigation along the lines of current density per cubic inch, or foot of solution, goes without saying, as you can plate say one small piece of work in a large solution to a current density so that it will plate twice as fast as you can a tank full of the same work, or visa-versa, according to the condition of the solution. I hope some day we will know more about this part of our work generally, as this applies to all solutions alike.

In conclusion, I might say that the plaster paris parts that I have done, were varnished instead of the lacquering as on the wood.

THE HABIT OF HELPING.

Have you developed it?

Have you made a practice of helping some other person over a rough place simply for the joy that you can get out of the act?

Have you ever experienced the exhilaration that comes from doing somebody else a good turn without expecting to be rewarded for it? Of course you have. Everybody does such things occasionaly, but did you ever think that it will be worth your while to repeat it? Dil you ever think that repetition means habit, and that good habits are worth cultivating?

Besides this, doing something for the other fellow occasionally brings into action a new set of faculties. Most of us have been wrapped up in ourselves so long that we can think of nothing else—can do nothing for anybody except ourselves. Let us cultivate the habit of helping others, of going out of our way to be of service to our fellow men—just because it makes us happy to help somebody else.—Fraternal Union.

Look not on yesterday, nor trouble borrow
Of what may be in store for you to-morrow.
The past is past, the present fills the air
This day, and this day only is our care.
Who gives each day the best that in him lies
Will find the path that leads to higher skies.

And once again St. Louis gets it in the jugular, a blooming left handed pitcher, with an 180 batting average, has to go and hit and hit a three-bagger with two on, and blooey goes our Federal League Pennant.

Now comes Cleveland and wants to count us out of fourth place. I suppose if H. Heavyweight Williams was still in Cleveland they would count him for two.

CONCERNING RAPID NICKEL PLATING SOLUTIONS.

A well known Platers Supply Company asked the following questions to promote open discussion of the characteristic properties of a rapid nickel plating deposit:

1. If as claimed these rapid solutions yield a deposit which is softer than is obtained when using the nickel salts alone, is it not possible that this softer deposit, although more economical to buff, is a less desirable deposit from the standpoint of service to the consumer? If we have made it easier to buff, have we not also made it easier to wear and erode in service?
2. Do these rapid nickel solutions furnish an electro plate with as enduring and permanent a lustre? We believe that in course of electrolysis, not alone is the metallic nickel deposit but there is also occluded a deposit of the metallic sodium, potassium or magnesium. The electro plate then being not one of pure hard nickel alone but rather a softer alloy of nickel and one or more of the other metals.

The metal content of a nickel solution or the kind of conducting salt used do not alone effect the characterictic properties of the electro deposit, the temperature and rate of deposition being important factors.

It is true that the current density which can be successfully applied in plating depends upon the density of the solution but the cause which limits the flow of current which can be used in a solution of low metallic content can be reached in a high concentrated solution. If, for example, a nickel solution containing 12 ounces double nickel salts per gallon and run at 70° F it is found that 3 amperes per square foot is the right current to use on steel which must be bent or curved after plating, a higher current giving a deposit found to be too brittle.

The plater may then use a solution of higher metallic content and with a good conducting salt run at 70°F and find that he can get satisfactory deposit using 5 amperes per square foot of cathode surface. If he should then further increase the current he would experience the same difficulties in obtaining a soft deposit as were encountered in the double nickel salt solution. These figures are merely used relatively for example to show that it is as much possible to get a deposit of any degree of hardness using a rapid nickel plating solution, as when using a double nickel salt solution. The operator must pay attention to the temperature and rate of deposition of the different classes of work.

Just a word concerning double nickel salts which has been referred to in solution as nickel salts alone. A double nickel salt bath is a solution of nickel sulphate with an ammonium sulphate conducting salt. This solution gives all the reactions for nickel, ammonium and sulphate, that is, all the ions are present. In the formation of the double salt, union does not take place until the solution reaches the point of saturation.

Sodium, potassium and magnesium are strongly electro positive metals and are deposited with difficulty from aqueous solution as they decompose water. The only method used to produce magnesium is to deposit it in a molten state from a fused magnesium salt. Sodium and potassium have a great affinity for oxygen and when the ions give up their charge during electrolysis of an aqueous solution, the metals decompose water, liberating hydrogen and forming sodium hydroxide or potassium hydroxide.

Under certain condition sodium may be deposited from an equeous brine solution. The strength of the brine solution is important if the sodium content is low hydrogen not sodium will be evolved. A cathode metal with high hydrogen overvoltage must be used with high current densities to secure a sodium alloy. Nickel has a very low hydrogen overvoltage and it would therefore be impossible to deposit a sodium and nickel alloy from nickel solution containing a comparatively small amount of sodium salt as a conductor.

In a paper written on the subject of single nickel salt solution, the writer gave a formula which contained one ounce nickel carbonate per gallon of solution. Since then inquiries have been received asking for the why of the nickel carbonate, saying it would not disolve to any great extent in a nickel sulphate solution. Nickel carbonate will not dissolve in a neutral nickel solution and was only added to the solution to keep it neutral.

If nickel is deposited from a nickel sulphate solution faster than it is dissolved from the anodes, the SO_4 radical unites with hydrogen forming sulphuric acid which causes an evolution of hydrogen at the cathode lowering the cathode efficiency.

The nickel carbonate is suspended in muslin bags in the solution and will neutralize any free acid and thus keep the cathode efficiency at its greatest. The solution mentioned in the paper was worked at high current densities and would not show as high anode efficiencies as would be possible under more normal conditions. At the same time let it be remembered that the primary object of the work is to deposit metal, hence nickel carbonate was used.

Different writers on the subject of single nickel salt solution claim anode efficiencies of more than 100% which may be possible with frequent small additions of acid, but not without a corresponding small cathode efficiency.

The writer is satisfied that a single nickel salt solution run under normal conditions will not gain in metal. To be convinced on this point prepare a solution of known metallic content and acurately measure its volume. After carrying on electrolosis for considerable time filter the solution and add water to bring it up to its original bulk and then test it for its metallic contest.

E. W. HEIL,
Wichita, Kansas.

FINANCIAL STATEMENT OF THE SUPREME SOCIETY A. E. S., AS OF DATE SEPT. 15, 1915, AND BUDGET FOR BALANCE OF FISCAL YEAR ON A BASIS OF 35 PER CENT AND 20 PER CENT PER CAPITA TAX, RESPECTIVELY.

ASSETS:

Cash on hand and in bank	$171.95	
Accounts receivable	135.60	
		$307.55

ESTIMATED INCOME:

P. C. TAX on 550 Members on a 35% basis for balance of the Fiscal Year	$721.86	
700 Membership Cards	14.00	
300 Application Blanks	6.00	
700 Cons. and By-Laws, 7c each	49.00	
Charters, (4) $1.00 each	4.00	
Electros, (4) 25c each	1.00	
Total estimated income		$795.96
Total estimated resources for balance of fiscal year on a 35% basis		$1,003.41

LIABILITIES:

SALARIES:

Editors	$100.00	
Secretary-Treasurer	60.00	
Mileage of Supreme Officers (estimated)	125.00	
Reporting Annual Convention (estimated)	60.00	
Accounts Payable	47.75	
Secretary's office expense balance of year (estimated		
Printing	25.00	
Postage and incidentals	38.00	
Cost of printing Review and editor's expense account, average 600 copies	396.00	

MISCELLANEOUS:

Printing 1000 copies revised Cons. and By-Laws	40.00	
Total estimated cost for balance of year		891.75
Resourse		1,003.41
Estimated balance on hand after 1916 Convention		$111.66

NOTE.—On a 20% P. C. Tax basis substitute $412.50 for $721.86 as above giving total resources of $794.05 and total expense (with three issues of the Review for the balance of the year) of $615.75, leaving a balance in the treasury after 1916 convention expenses are paid of $78.30. Neither of these two plans will furnish quite enough funds to finance the Supreme Society for the first three months of the 1916-17 year. It will require about $150.00.

W. FRAINE,
Secretary-Treasurer.

The recent death of Mr. Van Winkle, President of the Hanson and Van Winkle Co., at his residence, Newark, N. J., removes from the Plating Supply Industry a man who has been long and honorably identified with it.

Abraham Van Winkle with Edward Weston developed the first low voltage dynomo ever manufactured in America, and his name has ever been associated with progress in Electroplating in this Country. His loss will be keenly felt.

FULLY EXPLAINED.

A nervous lady stopped a baggage master and demanded to know why her train was arriving so late.

"Well," said he, "it's just like this: The train ahead is behind and this train was behind before besides."

A farmer in a chemical laboratory strayed,
'Tis true but sad to tell;
He mixed some glycerin with N O 2
And blew the J 2 L.

And this Review will go 2 L if you secretaries don't send in dope for publication. As long as the society wants the monthly Review, and I am the guy who has to get her out, she will sure make her monthly appearance, but honest fellers, I need material.
—ED.

CLEVELAND

Meets last Saturday of each month at Central Y. M. C. A. Secretary, Charles Werft, 331 Strathmore Avenue, Cleveland, Ohio.

The monthly meeting of the Cleveland Branch held Saturday, September 25. A good attendance being present. A welcome visitor to the Branch was Mr. Charles Proctor, who gave a very interesting talk.

Plans are under way for an anniversary banquet to be held in the month of December, the date which will be published later.

TORONTO

Meets fourth Thursday of each month at Occident Hall, Bathurst and Queen Streets. Secretary, Ernest Coles, P. O. Box 5, Coleman P. O., Toronto, Ont.

The regular meeting of the Toronto Branch was held on Thursday, September 23. President Salmon presiding over an excellent attendance. The question of the "Review" was disposed of in short order. The members being unanimously in favor of publishing a monthly under almost any reasonable terms. A lengthy discussion on the type and capacity of the generator for the laboratory was held, and the decision made, that a separately excited machine was the most desirable, and the capacity to be as large as can be obtained with the funds available.

A paper on the preparation, plating and finishing of high-grade small parts was presented and claimed the members' strict attention.

NEWARK

Meets first and third Friday of each month, 8 p. m., 47 Bank Street, Newark, N. J. Secretary, Geo. Reuter, Jr., 333 S. 19th Street, Newark, N. J.

The rally of our branch on October 1 at our laboratory, 49 Bank Street, was well attended. The meeting was called to order by President Faint, who declared all regular business set aside, and in a few brief remarks, stated the object of the rally.

Mr. Geo. Hogaboom of New Britain, Conn., was the first speaker of the evening and was very cordially received, his subject was "The Advantage of Knowing Your Solutions." He said the most important factor in electro-plating was to have your solutions chemically correct. Mr. Hogaboom also told of some of his experiences with brass solutions.

MILWAUKEE

Meets first Friday of each month at Eagles Hall, 137 Second Street. Secretary, E. C. Yaeger, 962 9th Street, Milwaukee, Wis.

DETROIT

Meets first Tuesday of each month at 26 East Congress Street. Secretary, B. E. Miller, 543 Townsend Avenue, Detroit, Mich.

Our regular meeting hereafter will be held on the first Tuesday evening of each month at 26 East Congress Street.

The regular meeting of October 1, 1915, was called to order by President A. E. Wetmore in the Chair, and a large attendance of members were present.

Application for membership was received from C. S. Tompkins, 595 17th Street, Detroit, Mich.

As Mr. H. J. Hawkins has retired from the business for the time being, it was moved and supported that he be carried on the roll as an honorary member, which is to show the appreciation this Branch has received from him in the past.

Moved and supported that Secretary write a letter of condolence to Hausen-Van Winkle Co. of Chicago, upon the death of Mr. Van Winkle, which was carried.

For the benefit of the society, Mr. C. T. Eickstaedt read a paper upon the subject of Lighting Fixtures and their finishes, the samples which he produced were very interesting, so much so, that a few pieces mysteriously disappeared.

Through the efforts of Mr. Woodmansee, the Detroit Branch has succeeded in entering a class of chemistry in the public school; the first lesson will be "The Determination of Nickel in Nickel Solution."

INDIANAPOLIS

Meets last Saturday of each month at Hotel Dennison. Secretary, Louis Mertz, 925 Chadwick Street, Indianapolis, Ind.

Indianapolis Branch September meeting was held September 25 at Hotel Denison, with B. Aufterheide presiding.

A. Nelson's resignation as secretary accepted and Louis Mertz appointed temporary secretary.

Motion carried that Supreme Society place per capita tax to meet all expenses.

ROCHESTER

Meets second and fourth Friday of each month at University of Rochester. Secretary, C. V. Haring, 603 Dewey Avenue, Rochester, N. Y.

BRIDGEPORT

Meets third Friday of each month at the office of the Brass World, 260 John Street, Bridgeport, Conn. Secrtary, Nelson Barnard, 858 Howard Ave., Bridgeport, Conn.

TOLEDO

Meets every Wednesday at Toledo University. Secretary, James E. Nagle, 209 Navarre Avenue, Toledo, Ohio.

Toledo Branch is not holding any regular business meetings at present as we are attending a chemistry class two nights a week and whatever business comes along we take care of on those nights.

We were very fortunate in having a special course in chemistry laid out for us at the Toledo University, with Professor H. R. Krieder as instructor. The desire of the average plater for an understanding of chemistry is evidenced by the way the members are going after the work. I predict that if the members stick to it as they have started, we will have some very able talent in Toledo Branch in time to come.

Applications for Membership

Detroit Branch:

C. S. Tompkins........595 17th Street, Detroit, Mich.

Toronto Branch:

John Lougheed........339 Lippincot Street, Toronto, Ont.
Thos. G. O'Keefe........676 Hurn Street, Toronto Ont.

Philadelphia Branch:

Harry Seaser........132 Bridge Street, Spring City, Pa.
Wm. P. Scott (associate)........415 Bulletin Bldg., Philadelphia, Pa.

Elected to Membership

Milwaukee Branch:

Fred Kummer........1005 Sycamore Street, Milwaukee, Wis.

Chicago Branch:

Anton V. Sedlack........317 S. 2nd Street, Maywood, Ill.
H. H. Wolverton........%Kalamazoo Stove Wks., Kalamazoo, Mich.
A. J. Hazucha........1842 Barry Avenue, Chicago, Ill.

Change of Address

D. Swanson........3022 Clifton Avenue, Chicago, Ill.
C. A. Manz........213 Marquette Blvd., Chicago, Ill.
J. Emmett........526 Grove Street, Laport, Ind.
John A. Wilkinson........271 S. 55th Street, Philadelphia, Pa.

CAN THIS BE TRUE?

A plater went to his home one night
A troubled, sad and dejected wight.
He welcomed the setting sun
He ate his supper and sought his room
With heart that was heavy and full of gloom
Though his daily work was done.

For everything had gone wrong that week
His very best tanks has started to leak,
And he couldn't make them stop
And just because the barrel was new
The shiners had kicked about the glue
Though it came from the very same shop.

His brass solution had acted mean
His new cleaning compound it wouldn't clean,
Although it was well recommended
For the dirt on the castings it just seemed to stick
You couldn't have pried it away with a pick.
His scrubbers were sorely offended.

His main countershaft had run hot all day long
And every dum thing had just seemed to go wrong.
And he thought of his troubles deep
And as he sat sadly, wearily thinking
His eyelids grew heavy and started a blinking,
And he sank in a troubled sleep.

And as he slept, he dreamed that he died
And passed through the Golden Gates opened wide.
Where nickel solutions ain't known,
And he got fixed up with his heavenly things
His golden harp and a pair of wings
His troubles forever had flown.

Here silver is silver and gold is gold
And iron for brass is never sold
Deception he always hated,
And looking around, his eyes always were sharp,
He happened to look real close at his harp,
And lo and behold it was plated.

—H. J. Richards.

The
MONTHLY REVIEW

Published by the

American Electro-Platers' Society

A SOCIETY FOR THE ADVANCEMENT
OF THE
SCIENCE OF ELECTROPLATING

NOVEMBER, 1933 **Subscription $3.00 a year**

Entered as second class matter at the Post Office at Springfield, Mass., September 8, 1930, under Act of August 24, 1912.

Acceptance for mailing at special rate of postage, provided for in section 1103, Act of February 28, 1925, authorized September 3, 1926.

NEW YORK

Meets second and fourth Friday of each month at 258 Pearl Street, New York City, 8 p. m. Secretary, Wm. Fischer, 345 East 23rd Street, New York City.

After the regular business routine on September 24, the Laboratory Committee gave an interesting lecture and demonstration on the preparation of a silver solution, showing the part that potassium and sodium cyanide play in the making up of such a solution. The lectures will be continued.

ST. LOUIS

Meets fourth Saturday of each month at Public Library Assembly Rooms. Secretary, F. C. Rushton, 4405 Blair Avenue, St. Louis, Mo.

The report of the Committee on Chemistry Class was to the effect that the Public School Board was not in a position to continue our work as a special class at present, owing to shortage of funds.

We were invited to join the regular night school classes; no action was taken, but committee was requested to see if some other plan for instruction could be arranged. Ed Musick, G. Lamkemeyer and F. Rushton are the committee.

Mr. Robt. Fischer, our instructor at McKinley High School last year, and Mr. Troxler of Newark Branch, were visitors and gave us suggestions.

We had expected some facts on the Single Nickel Salt proposition from G. S. Robins, but it was learned that he had side-tracked the Single proposition and had gone to New Jersey to Double up, it was also learned that the Robins will nest at Webster Groves, Mo. for the present. We extend our congratulations and best wishes.

DAYTON

Meets first Wednesday of each month at the Y. M. C. A., Dayton, Ohio. Secretary, Alphonz Lamoureux, 500 East First Street, Dayton, Ohio.

BUFFALO

Meets first Saturday of each month at the University of Buffalo, 8 p. m. Secretary, John G. Murphy, 71 Dingens Street, Buffalo, N. Y.

CINCINNATI

Meets once each month at Dennison Hotel, Cincinnati, Ohio. Secretary, F. H. Nordmann, 720 Froom Ave., Cincinnati, Ohio.

WHAT THE BRANCHES ARE DOING.

Art. V.—Sec. 3 of our constitution reads as follows:

It shall be the duty of the Secretary to keep an accurate report of the proceedings of each meeting, which is to be recorded in a book for that purpose. He shall send to the editor a copy of all such reports with names of all applicants for membership and all papers for publication. He shall keep an itemized account of all receipts and expenditures. He shall also act as Corresponding Secretary.

As we depend on the branch secretaries for the information concerning meetings, we hope to make these items more interesting with their co-operation.

CHICAGO

Meets fourth Saturday of each month, 8 p. m., Western Building, Randolph Street and Michigan Avenue. Secretary, H. E. Willmore, 5911 South Boulevard, Chicago, Ill.

The regular monthly meeting was held Saturday, September 25, with O. E. Servis presiding. Mr. W. G. Meggers was elected to the office of Librarian, owing to the inability of Mr. Chas. B. Wrout to continue to serve. The Educational Committee was instructed to continue its efforts to secure instruction for a class in chemistry at one of the Technical High Schools.

Mr. S. E. Huenerfauth gave a very interesting description of a method of converting an alternating into a direct current for plating purposes by means of a rotary converter and explained in detail the economy of its application.

On the two questions submitted by the Supreme Society, Chicago Branch voted unanimously to adopt the 35 per cent method, whereby the publication of the "Monthly Review"' will be continued.

PHILADELPHIA

Meets first Friday of each month in the Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Streets. Secretary, Philip Uhl, 2432 North Twenty-ninth Street, Philadelphia, Pa.

The regular monthly meeting was held October 1, with President Bau presiding.

This Branch voted unanimously in favor of the Supreme Society levying a 35 per cent per capita tax to defray the expenses of the Supreme Society and continue the Review as a monthly publication.

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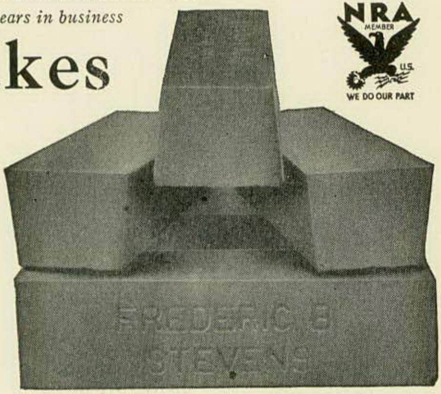

MONTHLY REVIEW
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EDITORIAL

N.R.A. and the Electro-Plating Industry

F. F. Pierdon
Baltimore-Washington Branch

The general purposes of the N.R.A. are well known. This article is a brief summary of the steps that have been taken that may affect the plating, polishing and rust-proofing industries, and the activities that are necessary for a completion of this program.

Even though the American Electro-Platers' Society is not in a position to officially discuss such questions as hours and wages, it is the logical organization to propose standards of quality that may be incorporated into the codes. It is important therefore for all members of the A.E.S. to become familiar with the plans of the N.R.A.

This field comes under the immediate supervision of Major J.A. Hillman, of the Division of Control. Soon after the N.R.A. plans were announced, codes for the plating industry were proposed by Master Platers' Institute, Richard Nagle, Secretary, 3835 Seiss Avenue, Toledo, Ohio, Chromium Platers' Guild of America, Philip Sievering, Secretary, 199 Lafayette St., New York; Association of Electroplaters' of Southern California, G. W. Kyle, Secretary, 1151 South Broadway, Los Angeles, Calif; The Plating, Rust Proofing and Enameling Association of Michigan, Douglas O. Crane, Secretary, 2415 Darlum Tower, Detroit, Michigan. In addition to considering these codes, the N.R.A. officials conferred informally with job platers of Baltimore and Washington, including the author of this report.

It soon became apparent that no present organization fully represents the job plating industry, a primary requirement in the preparation of such codes. Before a detailed code for the plating industry can be adopted, it is necessary to form some organization or group that will be able to speak for the whole industry. All interested persons are therefore urged to join some such body and to urge cooperation or consolidation of the various agencies.

In the meantime it may be possible to adopt a basic code, which will be similar to that for related industries. At present it is proposed to apply to the job plating industry the code which has been proposed for the Fabricated Metal Products Industry.

This will still permit the adoption of a supplementary code for job plating where this industry is sufficiently organized.

In order to assist in bringing about this agreement the Author will be glad to send to any interested persons or organizations, without charge, any government publications that are available and transcripts of discussions, for which the official charge is 2c per page. Please send such requests to F. F. Pierdon, 923 - 12th Street, N. W. Washington, D. C.

Substantial progress has been made and if those interested will cooperate fully a code can be prepared which will serve the purposes of the N.R.A. and be of great value to the job plating industry.

TO ALL OUR BRANCHES

It is important that all our branches vote at the earliest possible time on the dates June 11, 12, 13, 14 proposed by the Detroit Branch to hold the 1934 Convention. Notify Secretary Gilbertson when the vote is taken.

WHY NOT?

In traveling around the industrial plants, we come in contact with a number of men, high class men, who have devoted all their lives to the finishing business. They are men who have to spray lacquer on plated finishes and have to do Japan work after the material has been prepared by the plater. There are a large number of finishers who do not know how to plate, but who know the art of finishing in other forms, including gilding, mask work, graining and blending. They are men who can make a plated job look better, men who take pride in doing good work, and men who could be a big help to the Electro-Platers Association. They would add a new enthusiasm to the association and increase its membership a great deal.

So far I have been unable to discover any association of finishers but they will have one some day, if they haven't one already. Why not have a drive to see if we can get some of them to join our organization, for the finisher has to work hand and glove with the plater. Why not?

I would like to hear what some of the other members have to say on this subject.

E. M. Stephenson
Member Hartford-Conn. Valley Branch

METHODS OF STRIPPING PLATED COATINGS

A. Brenner (Read by Dr. William Blum)

Read at Chicago Convention 1933

I. INTRODUCTION

This investigation includes studies of the removal of plated coatings for analytical purposes and for replating. These processes may be designated respectively as (a) analytical stripping and (b) commercial stripping. This progress report is confined to the consideration of the removal of nickel, copper and chromium from steel or from each other. Further studies will include stripping of these coatings from other base metals, and also stripping of zinc and cadmium from steel.

II. GENERAL PRINCIPLES

It is expected that the exposure tests now in progress will furnish information that may serve as a basis for specifications for plated coatings. If such specifications involve the thickness of the deposits, it is necessary to have simple reliable methods of determining the thickness. For most purposes the average thickness is specified. This can be most readily ascertained by dissolving the coating, determining its weight, and calculating the thickness from the measured area of the piece. The ideal stripping method is one in which only the coating is dissolved, so that its weight is equal to the loss in weight of the object. In the absence of such a method, it is necessary to dissolve the coating along with some of the base metal, and determine the weight of the coating by analyzing the resulting solution.

When there is only one metal layer on the base metal it is necessary merely to find a reagent and conditions that will dissolve the coating in a moderate time, without attacking the base metal to the extent of more than a few per cent of the weight of the coating. As will be shown, this can usually be accomplished. If, however, as is frequently the case, the coating contains three or more layers of different metals, it is desirable but difficult to dissolve the metals successively. This difficulty arises from the fact that plated coatings are rarely impervious. Hence a reagent that will dissolve metal "a", but not the next layer "b", may get access to layer "c" that is under "b". With coatings of good quality this difficulty may not be great, but with very thin and porous coatings it is serious.

It is often necessary to remove plated coatings prior to the replating of defective or worn articles. For this purpose a slight attack of the base metal is not objectionable, provided that pitting does not occur. The cost of reagents and the time required are more important for such stripping than for analytical purposes.

III. RESULTS FROM EXPERIMENTS

1 — Nickel from Steel:

(a) Reversed current in sulphuric acid. Nickel becomes passive and dissolves very slowly with reversed current in concentrated sulphuric acid. This passivity is accompanied by a visible film of anhydrous sulphate on the anode surface. If the acid is diluted, the nickel dissolves more rapidly, but the steel is then also attacked. The best results were obtained in 70 per cent acid (made by mixing 13 volumes of concentrated sulphuric acid and 9 volumes of water). An anode current density of not more than 20 amp/sq. ft. (2 amp/dm^2) should be used. At best the steel is somewhat attacked, so the method is not suitable for a weight determination. The tendency toward pitting can be reduced by the addition of 2 oz/gal (15 g/l) of glycerin.

(b) Reversed current in a cyanide solution. This is not very satisfactory because the last part of the nickel is difficult to remove. With a solution containing 27 oz/gal(200 g/l) of sodium cyanide at 160 degrees Fahrenheit (70 degrees Centigrade), and a current density of 20 amp/sq. ft. (2 amp/dm^2) the nickel was removed from about half the surface in a short time, but it required nearly a day to remove all of it.

(c) Immersion in nitric acid. Concentrated nitric acid dissolves nickel so slowly (about 0.001 inch in 6 hours) that it is not good for commercial stripping, though useful for analysis. For the latter purpose the concentrated C. P. acid (68-70 per cent) should be used. When the nickel is all dissolved, the article should be rinsed quickly and thoroughly to prevent solution of the steel by the diluted acid. If the article has a complicated shape so that it it difficult to rinse, it may be dipped in a twenty-five per cent solution of chromic acid before rinsing in water. The accuracy of the nickel determination by loss in weight is within two per cent.

The method may be used to strip composite coatings of nickel-copper-nickel from steel, but not coatings with copper next to the steel.

(d) Immersion in mixtures of nitric and sulphuric acid. The following mixture is typical of those recommended in the literature:

Sulphuric acid (60 degrees Be′)	4000 ml
Nitric acid (40 degrees Be′)	500 ml
Potassium nitrate	50 g
Water	500 ml

This reagent is unsatisfactory. It dissolves the nickel as slowly as does nitric acid, and attacks the steel as much as does the reversed current in sulphuric acid.

(e) Reversed current in sodium nitrate. The best method found for stripping nickel from steel, either for replating or analysis, was with reversed current in hot sodium nitrate solution. A concentration of 3 lb/gal (360 g/l) is sufficient, but higher concentrations permit higher current densities and more rapid stripping. The solution is heated to about 200 degrees Fahrenheit (90 degrees Centigrade). An anode current density of 100 amp/sq. ft. (10 amp/dm^2) should be used in the above solution, while 300 amp/sq. ft. (30 amp/dm^2) may be used in a solution containing 6 lb/gal (720 g/l) of sodium nitrate. The solution is used in an iron container which also serves as a cathode.

Under these conditions nickel is dissolved rapidly, generally in about one-third the time required for plating. Copper also dissolves, so that composite coatings are completely removed from the steel. The latter is practically unattacked, although case-hardened steel is slightly etched.

This stripping solution gradually becomes alkaline, and basic compounds of nickel (and copper) precipitate. Nitrates also form in it. To keep it effective the solution should be kept nearly neutral by occasional additions of nitric acid. (As this acidifying evolves oxides of nitrogen, the tank should be ventilated). The pH is not critical, and can be regulated by keeping the solution acid (colorless) to phenolphthalein and alkaline (yellow) to methyl red. Chlorides should be absent as they cause the steel to be attacked.

2 — Copper from Steel or Nickel:

For replating, it is desirable to strip composite coatings in one operation. For testing, however, it is preferable to remove the layers consecutively. For example, the nickel may be removed by reversed current in sulphuric acid, after which the under layer of copper is removed from the steel (or from an initial nickel layer).

(a) Immersion in acidified chromic acid. A solution containing 4 lb/gal (500 g/l) of chromic acid and 7 oz/gal (50 g/l) of sulphuric acid dissolves copper rapidly without attacking steel or nickel. For example, it removes 0.0005 inch of copper in 10 minutes with an error of less than one per cent. When the solvent action decreases, more sulphuric acid may be added, but the total concentration of free sulphuric acid should not greatly exceed 50 g/l, as then the steel is attacked.

(b) Reversed current in chromic acid. Copper dissolves anodically in a solution containing 33 oz/ga (250 g/l) of chromic acid, and an anode current density of 50 amp/sq.ft. (5 amp./dm_2).

(c) Reversed current in sodium nitrate. Copper can be dissolved by reversed current in a solution containing 24 oz/gal (180 g/l) of sodium nitrate at room temperature. Under these conditions the steel is unaffected but nickel is slightly attacked.

3 — Chromium from Steel or Nickel:

(a) Immersion in dilute hydrochloric acid. Concentrated hydrochloric acid diluted with ten volumes of water rapidly dissolves chromium from nickel at 120 degrees Fahrenheit (50 degrees Centigrade), with an error of less than three per cent for thin chromium coatings. It is not applicable for stripping chromium from steel or from steel plated with a thin (and porous) nickel deposit.

(b) Reversed current in sodium hydroxide. Chromium is quantitatively dissolved from nickel or steel by a reversed current in a solution containing about 12 oz/gal (90 g/l) of sodium hydroxide.

(c) Reversed current in sodium carbonate. In a solution containing about 16 oz/gal (120 g/l) of sodium carbonate, a reversed current dissolves the chromium, but more slowly than in sodium hydroxide. This method is useful for stripping chromium from nickel on zinc-base die castings, or when there is a layer of zinc or cadmium under the chromium or the nickel. Zinc and cadmium are not appreciably attacked in sodium carbonate soln.

Chairman Slattery: If there are any questions on Mr. Brenner's paper, I am sure Dr. Blum will be pleased to answer them.

Mr. Hogaboom: It is strange how things get hidden. After the work of Dr. Burgess put that in and sent out some of their old catalogs and it is in books on using sodium nitrate or acid sodium sulphate for the stripping. Burgess developed it.

Dr. Blum: Has it been used for stripping nickel?

Mr. Hogaboom: Yes. It is used quite extensively. We have been doing considerable work on stripping deposits on account of the requirements that are being demanded, and we have struck on two simple methods which have given us very good results. One suggested to us was that of stripping nickel from steel direct. It does not affect the steel. We have made a great many experiments and we can find there was no attack on the steel at all. We can remove the nickel in a very few seconds in fuming nitric acid. That will take the copper and the nickel-copper-nickel, so that you can remove those coatings readily in fuming nitric acid. For stripping copper deposits we used cyanide to which we add hydrogen peroxide. Cyanide strip is slow. The addition of hydrogen peroxide accelerates the action; you can remove it in a short time by the addition of hydrogen peroxide to the cyanide solution. There is no effect on the steel at all, so that it can be determined directly by weight. One of our men at the laboratory has devised what I think is an exceedingly unique way of measuring surface areas. It may be used by a number of you, but we have not seen it before. He takes a piece of this paper for plotting curves which have definite squares divided into a large number of smaller squares and passes that over and counts the number of small squares. In that way he can determine the surface area very rapidly without a complicated measuring of the area with some fine instruments.

Dr. Blum: That point, Mr. Hogaboom brings out, is an essential part of the stripping method for analytical purposes, for there is no use in determining the weight of the coating unless you have some means of estimating the area, if the thickness is specified. We know from our experience with teaspoons, forks, knives, and that sort of thing that it is very difficult to measure those areas with high accuracy. I believe that by such methods as Mr. Hogaboom has suggested, simply by methods of adaptation, you can get them within ten per cent, but I would hate to say that any of those areas could be measured very accurately.

MR. HOGABOOM: It works easily anyway, and you can use a solution over several times if you wish. Of course, a fresh solution works rapidly and is especially good for gold as well as silver. One of the difficulties we had in stripping gold from brass to determine gold was overcome by just using cyanide with the hydrogen peroxide, and our troubles were over.

MR. C. F. NIXON: Does the investigating conducted by the Bureau cover stripping copper from zinc?

DR. BLUM: We have not attempted that so far. The field is enormous, because so far we have worked entirely with steel as the base metal, and this report is confined to copper, nickel and chromium. Regarding work with other base metals, I was trying to recall a method I know Mr. Brenner used in a few experiments which he thought were promising for removing nickel from zinc but I wouldn't want to quote them from memory, because I do not have a record of them. We did not go into stripping copper from zinc.

THE USE OF ACIDS IN THE PREPARATION OF STEEL FOR PLATING

Walter S. Barrows

Read at the Chicago Convention, 1933

Throughout my plating experience of forty years I have been partial to the use of sulphuric acid in the preparation of steel surfaces for plating. I have never encountered a condition of steel, iron or stainless steel which could not be treated successfully by use of sulphuric acid. It is rapid in its action, easily neutralized if the case requires neutralization, it is not unpleasant to use, the surface of a sulphuric acid dip is easily kept clean and if the container is properly supplied with lead draining strips the adjacent fixtures, if any, are not quickly corroded by its fumes.

Many platers and writers of prominence regard sulphuric acid as the logical acid to use prior to nickel plating. On the other hand, many platers of long experience have always given hydrochloric acid preference. If we disregard early training, preferences and much that we read and hear, we must admit that the rapid disastrous rusting of all ferrous metals exposed to air in the vicinity of soldering outfits where zinc chloride is employed, the fouling of all ferrous metal surfaces exposed to contact of ammonium chloride, sodium chloride, etc., is not conducive of confidence respecting the use of hydrochloric acid prior to plating.

To a young plater who undertakes to launch out into a future of successful adventures in the field of electroplating, the literature of plating is more or less confusing with reference to acid treatment of steel. One author warns his readers against the use of nickel solutions containing chlorides when plating steel or iron, and only a few years ago many platers were strictly following the advice. On the other hand, some authors present formulas, descriptions of methods and outlines of processes, etc., in which the use of hydrochloric acid is not only suggested by actually indicated or given preference.

For years a large percentage of the nickel plating baths used for commercial nickel plating have contained chlorides in some form and the results as viewed from various angles have been greatly to the credit of the chloride nickel bath.

If the young plater is satisfied that chloride nickel plating baths are safe to use when plating steel, he may ask, "Does the use of hydrochloric acid as a dip prior to plating create a condition more favorable to rust than does sulphuric acid? A very common answer to that question has been, "I've used it for years and never had any trouble." Although I always preferred sulphuric acid I have never been prejudiced, and early last summer decided to try out a few experiments which might indicate more or less assuringly whether the effect of hydrochloric acid is more liable to prove harmful to an electrodeposited coating than is the effect of sulphuric acid, if each acid is used with a reasonable degree of care.

For the purpose of the experiment approximately fifty pieces of hard cold rolled steel were prepared. Each piece was wired separately, electro-cleaned and plunged directly into a twenty-five per cent (by volume) solution of sulphuric acid, rinsed through running cold water and placed in a solution of sodium cyanide which registered a density of five degrees Baume. Three minutes were allowed to pass before the first piece was taken from the cyanide. As the pieces were taken from the cyanide the subsequent treatment differed. At least twelve series were made and may be indicated as follows:

25% Sulphuric acid, double rinse, nickeled direct.

25% Hydrochloric acid, double rinse, nickeled direct.

25% Hydrochloric acid, rinse, 25% sulphuric acid, double rinse, nickeled direct.

25% Sulphuric acid, rinse, 25% hydrochloric acid, double rinse, nickeled direct.

66 degree Concentrated H_2SO_4 45 seconds, double rinse, nickeled direct.

22 degree Concentrated Hcl 45 seconds, double rinse, nickeled direct.

Copper strike one minute, rinse, 25% H_2SO_4, rinse, nickeled.

Copper strike one minute, rinse, 25% Hcl, rinse, nickeled.

Copper plated three minutes, rinse, cyanide dip, double rinse, nickeled.

10% H_2SO_4, copper plate two minutes, H_2SO_4, rinse omitted, nickeled.

10% Hcl, copper plate two minutes, Hcl, rinse omitted, nickeled.

Electro clean, cold rinse, scoured with pumice, rinsed and nickeled direct.

No consideration was given details of nickel bath condition. All the pieces were nickeled one hour in the same bath and at the same time. The nickel bath was one year old and when prepared the constituents and amounts per gallon were Nickel Sulphate crystals 24oz, Nickel chloride 3oz, Boracic acid (pulverized) 3oz. Nickel anodes were of the 95-97 per cent variety. Temperature of bath = 85 degrees Fahrenheit. Voltage = 1 4/5 volt. Current density = approximately 10 amperes per square foot. Ph of nickel bath = 5.8. No attention was given the chemical equivalent strength of acid dipping solutions, the percentages given were by volume in all instances. Both undiluted acids were heated to 140 degrees Fahrenheit. When the pieces which were transferred directly from the acids to nickel bath were immersed in the bath and connected to the negative rod of the plating tank, violent gassing occurred for several seconds.

Some of the pieces which were not given any finishing treatment such as polishing, tumbling, etc., were quite seriously pitted on one side only when taken from the plating bath. As this particular bath has not produced pitted work, and as all the other pieces plated at the time for this test were not pitted, I am inclined to think the pits were in the steel. All edges of the pieces plated were rough. About fifty per cent of the pieces were three sixteenths of an inch thick and the lap caused by the punching die extended over approximately one-half the thickness. All the pieces were strung on a strong linen cord in such a manner as to avoid contact one with the other when arranged in a wooden rack built specially for the purpose. All pieces were suspended at the same level, that is, there was no possibility of drip from one specimen falling on another specimen. The rack containing the pieces was placed on the roof of a shed in a residential district of Toronto, Canada, Thursday, August 4, 1932, and was inspected at intervals of one week. The first trace of rust was detected at the end of the third week. A superficial film extended around the edge of some pieces, but it was only upon the half not covered by the lap made by the punching die mentioned previously.

As a matter of fact, these pieces were from the series treated with hydrochloric acid and plated direct. Changes in the condition of the surfaces of the various pieces were gradual during the winter months. Mounds of rust have formed over each pit, but the surfaces surrounding the pits remain in good condition. No evidence of blisters is to be found on any of the pieces. After ten and a half months' constant exposure to the elements we now find practically no difference in the condition of the various pieces. If we ignore the pits, which are obviously from the base metal, we may regard all the pieces as in good condition. As we have found no reasonable excuse for condemnation of any particular acid by reason of this simple experiment, may we not profitably give attention to methods employed in the use of acid dips for steel?

ACID DIPS AND METHODS FOR USING

The use of a twenty-five per cent solution sulphuric acid as a dip for steel directly following alkaline cleaning (either with or without electric current) is an old idea. It was used effectively and successfully long before I was initiated into the mysteries of the the science of plating in the early nineties. It has effected marked reduction in time and labor necessary to clean a wide range of products which are plated. It is dependable. It is economical for the manufacturer and a boon to the electroplater. If, however, an operator does not adhere to certain simple rules he is sure to have trouble. An abundance of clean running water and a cyanide bath of ample capacity to accommodate sufficient work to permit the shortest period of immersion to be at least two minutes are essentials which should be given first consideration. Steel which is treated in an acid dip or pickle, swilled in a rinse water which is nearly as dense as the acid, and transferred to a plating bath to receive a thirty-minute deposit of nickel, with a current density of less than ten amperes per square foot, is not getting a fair start in life as a plated object.

Furthermore, when a piece of steel or iron is removed from the alkaline cleaning bath and intended for plating, the "stop over's" if any, should not be in foul rinse water or in the air, especially after acid treatment.

During the summer months steel parts which have been polished, tumbled or otherwise prepared for plating and subsequently remain in storage in the plating room, often acquire patches of rust which the electric cleaner loosens but does not remove. In such cases the momentary plunge direct from cleaner into warm sulphuric acid removes practically every trace of the rust and permits the usual operations to follow without interruption. Some platers have difficulty when plating malleable iron. The acid plunge removed the difficulty.

I believe it is better practice to acidulate the surface of a copper deposit by use of very dilute hydrochloric acid, if the article is to be plated in a neutral nickel bath, than to use cyanide as the means of removing possible oxides. But if the copper plated object is to be plated in a nickel bath of usual acidity, I prefer cyanide as the final dip before rinsing for immersion in the nickel bath.

Another point: Neutralization of strong acids upon the surface and in the pores of steel or iron can best be effected by use of the cyanide solution. Soda solutions are not reliable. I have seen steel acquire a film of green rust while suspended in a solution which the plater called a neutralizing bath. When certain grades of steel are plunged into a warm 25% solution of sulphuric acid the reaction during immersion in the acid causes liberation of gas which adheres to the surface of the steel through the rinsing operation and during a three minute immersion in the cyanide solution. Usually this condition denotes weak cyanide solution. If the gas is not removed from the steel surfaces before placing in the plating bath, pitting results.

In the use of concentrated sulphuric acid as a dip for hard steel a slight film may be noticeable when the steel is taken from the acid. This film will disappear if the object is allowed to remain suspended in the rinse water for a few seconds only, and then vigorously agitated in the water before transferring to the final rinse.

The ideas briefly mentioned in this paper are not intended for the plater in charge of a large plating plant where work is prepared and plated by means of mechanical devices. The acid dip mentioned and the use of cyanide as indicated is most practical for the plater who either performs the operations or supervises various sections of a relatively small plant. I have omitted reference to the use of the electric current as an aid in acid treatment of steel simply because my contact with platers has caused me to think that the majority of platers adopt new electrical methods rather slowly and as yet my experience with either anodic or cathodic acid treatment has been very disappointing with respect to time and labor saving.

Many splendid effects may be obtained by the use of the electric current, one or two simple chemicals and a little common sense, but perhaps we will take that up at some later date. For the present I want to try to impress the plater who wants a faithful helper and I can suggest nothing better than the sulphuric acid dip described in this paper. I cannot recommend the use of this dip as herein suggested for steel, for treatment of ordinary cast iron. If a dip of this type is employed for cast iron it will be found advantageous to prepare a solution with a lower percentage of sulphuric acid, or if it is necessary to only occasionally use the twent-five per cent solution for cast iron, the casting should be slightly cooled by a very brief immersion in the rinse water. It is also good practice to always agitate the parts vigorously in the cyanide immediately before removal for any subsequent operation.

It may be advisable to state that I use acids freely prior to deposition of thick coatings of copper and nickel and peeling or premature breakdown of the coatings is of rare occurrence. For hardened steel which has been cleaned of scale, we use the concentrated sulphuric acid at a temperature of about one hundred and forty degrees Fahrenheit. If, as in some cases, the acid treatment must be prolonged sufficiently to produce a reddish discoloration of the steel surfaces, suspend the steel in a cyanide solution for a few minutes then acidulate the surfaces before proceeding to the plating bath. Parts which are quite smooth before cyanide heat treatment ordinarily require little if any tumbling, the acid dip cleans the surfaces quickly and thoroughly so that a white nickel finish is easily obtained.

If you are having difficulty with any grade of steel try the sulphuric acid plunge direct from the cleaning bath. If you are required to reduce a tap or threaded die, try hot concentrated sulphuric acid and the electric current, you will find you can control the reduction easily and with very little practice produce a really creditable job. By using auxiliary dips various effects can be obtained, particularly on hardened steel surfaces.

CHAIRMAN SLATTERY: Are there any questions on Mr. Barrows' paper? Thank you, Mr. Barrows.

MR. GARTLAND: I would like to ask Mr. Barrows how he handles the small steel parts for barrel plating, especially in nickel, and the method employed and what metal he uses in the baskets.

MR. BARROWS: We use steel baskets which we make from scrap taken from the stamping department, strips from which washers, nuts, or such things, are punched out. The ones we use for barrel work are six inches wide. We make a basket six inches deep and six inches in diameter. We use perforations according to the work for which the baskets are used. If necessary, the work is tumbled in saw dust or shavings, if it requires cleaning, and placed in a cleaning solution made up of any ordinary cleaner, not too strong, and dipped into the twenty-five per cent sulphuric acid rinse and hung in cyanide, sodium cyanide. Then we proceed to get on the next batch. Take the work out of the cyanide and rinse it in two rinses of water and apply the nickel.

MR. SIEVERING: I should like to ask whether he recommends running the basket work from the cyanide rinse or from the acid dip into the rinse and then into the barrel.

MR. BARROWS: In ordinary soft work, I would take it right from the acid dip and give it a double water rinse and then right into the nickel solution. There is no need of going into the cyanide dip at all.

CADMIUM PLATING ON FULL AUTOMATIC MACHINES

F. L. Greenwald

Read at Chicago Convention 1933

The advent of the all electric Radio and the Electric Refrigerator, some few years ago, made a sudden and large demand for Cadmium Plating. Its silvery white appearance, the ease with which it can be soldered, its protective value upon steel and iron and its throwing power made it particularly desirable on that class of work. Therefore when hundreds of thousands of parts were required daily, ranging in size from small screws to the radio chassis and refrigerator mounting plate, what would be more natural than to turn to automatic machinery to supply this demand.

The majority of the parts that go into a radio or refrigerator are constructed of steel and are plated without any polishing or buffing. Such parts as were made of brass or phosphor Bronze were Cadmium Plated to facilitate soldering and give the assembled piece a uniform appearance.

A machine set up for Cadmium plating steel will plate brass without any difficulty. The proper arrangement of the various tanks and the length of time the work stays in them is usually taken care of by the manufacturers of the machine after they are informed as to what sort of a plate is required and on what kind of metal.

The parts to be plated are sometimes received from several different sources making it a difficult problem to clean successfully, especially so, where no washing operation is used prior to loading on automatic plating machines. In cleaning work for plating or pickling it is well to check up occasionally on the lubricant which is used in stamping or drawing the various parts as well as the lubricants used in machining parts.

At one time we received a run of work from the press room which did not plate properly although run under same conditions as previous parts, and upon investigating we found that the press room had used heavy machine oil, when someone got into the wrong oil drum. On another occasion someone got hold of a can of varnish and applied it to sheet steel which was to be formed. Some of those parts got to the Plating Department and were run through plating machines. Needless to say, they were rejected for poor plating.

It is almost too much to ask a cleaner to remove these materials without some mechanical action. At times on certain parts, where a deep draw is required, the press room insists it is necessary to use white lead or graphite in oil, either one of which is difficult to clean when putting it directly on an automatic machine. The oil will be removed but the lead and graphite will remain on the metal. Obviously, the way to handle such parts is to run them through a washing machine where they get the spraying action which washes lead and graphite off with mechanical action along with oil. Work can be cleaned economically in a washing machine because a weak cleaning solution can be used and then changed oftener.

Before the days of plating machines, when each job was handled individually, the cleaning job could be done according to its particular needs. With an automatic plating machine, such is not the case; every piece passes through exactly the same treatment, and if everything is in order the work will come out o. k., but if the cleaners, dips and plating solutions are not in condition, you are in for some rejected work. The proper thing to use would be a washing machine to insure uniformly clean work going on the plating machine. But where a washing machine is not available, it is possible to take work just as it comes from the press room, load it directly on the plating machine and still get good results, provided a good electric cleaner is used.

We have operated three full automatic plating machines for several years, handling parts of every shape and size and in almost every condition imaginable, without previous cleaning of any kind. Of course, we have had to carry our electric cleaner stronger than would have been necessary had we used a washing machine. Several cleaners we tried gave us considerable inconvenience by forming a heavy foam which held the generated gasses until a spark from the work carrier would ignite same and cause an explosion. Eventually, we found a cleaner which did a good job and did not form a heavy foam.

The work remains in the electric cleaner three minutes at a current density of thirty amperes per square foot. The 1500 gallon steel tank is used as a cathode and the work as an anode. The reason for the reverse current is that we got a much clearer surface on work. When direct current was used we got a film of tin on work; this tin had been deposited on sides of cleaning tank when we reversed current to back tin off a batch of tin plate. On cleaning tank we have installed a compressed air spray to keep floating grease and oils away from work when it enters and leaves solution, at the same time it blows steam and fumes toward an exhaust hood placed at other end of tank.

To get full benefits of an automatic plating machine, racks should be used for the various parts to speed up the loading and unloading of machines.

Following the electric cleaner comes a hot water rinse of ten seconds. It is used hot for better rinsing results and also permits work to pass into the pickle in a heated condition helping to keep it at the proper temperature. The 20% muriatic acid pickle, run at a temperature of 120 degrees F. is expected to and does take care of ordinary rust, scale and electric welding spots. Time of pickling is one minute. Capacity of tank is 600 gallons. When we receive a batch of steel that is exceptionally bad due to rust or scale, we have parts pre-pickled before going on the machine. Acid pickle is equipped with compressed air spray same as cleaning tank and for the same purpose. Pickle tanks are rubber lined steel and are heated with steam injected through lead pipe.

We have been unable to obtain a coil that would last a reasonable length of time, so we continue to use a steam jet although it does raise the level of acid until it is necessary to dip it out to keep from running over. This is not such bad practice as it seems for by dipping out part of old solution and adding fresh acid occasionally we avoid recharging entire tank as often as would be necessary if none were removed.

Following the acid pickle is a 750 gallon cold water rinse with water spray playing on work carriers at this point, it being the most convenient place on machine, this washes off any cleaner or pickling acid and helps to keep contacts between carrier and plating racks clean. Length of time in above rinse is one and one-quarter minutes.

On account of parts picking up some grease from acid, a warm sodium cyanide electric cleaner is used just before work enters cadmium plating solution. This cyanide solution contains 5 ounces cyanide per gallon and direct current is used at 20 amperes per square foot for one minute. It is not necessary to rinse parts before going into plating bath as the drag out from cyanide cleaning solution tends to keep up free cyanide content of plating bath and if cyanide cleaner were carried strong enough you could have practically a self-sustaining solution as the anode surface may be controlled so that sufficient metal is dissolved at anodes.

The original plating solution was installed by the Udylite Process Company. The anodes used are ball shaped and are dropped into spiral steel wire containers making it possible to have a constant anode surface by keeping baskets filled and at the same time supply the necessary steel anode surface. At 25 amperes per square foot a nice bright silvery deposit is obtained on a reasonably bright surface. It should not be necessary to add metal to solution if sufficient anode surface is employed. To the contrary, if too much anode surface is used the metal content will have a tendency to increase.

Work may pass through the plating solution at a low current density and receive a dull blue-gray deposit, whereas the same load if run through at a higher current density would obtain a bright silvery deposit. The majority of parts when properly racked so that projections towards anodes are minimized, can be run through plating tank at a current density of 25 to 30 amperes per square foot with the above results. A 3000 ampere 6 volt motor generator set is used on a 2800 gallon tank of solution.

The plating solution is operated at room temperature with a single steam pipe on bottom of tank to raise temperature on cold mornings when it is inclined to fall below the desired figure.

The length of time work remains in plating tank is six minutes and the bath is operated with six ounces free cyanide, two ounces metal, and five ounces carbonates. The first water tank following the plating solution is used to catch the drag out, and this rinse water is used to raise the level of plating solution when necessary, the work remains in this tank twenty seconds. The parts should be racked in such a way that as little as possible of the solution is carried out of the various tanks, at the same time considering how the parts will be best plated.

Next in line on machine is a 300 gallon tank of running cold water in which the work remains ten seconds, after it passes through this rinse tank it is lowered into an empty 300 gallon tank equipped with four sprays which play cold water upon the work for ten seconds as it is being lowered into and raised from the tank. This spraying of clean cold water upon the work is a sure way of having all work pass through water that is in no way contaminated with plating solution.

From the spray tank it is finally submerged for thirty seconds in the 400 gallon tank of hot water. This water is kept boiling and contains enough of a potassium soap to give it a milky color.

Following the hot water rinse the parts are thoroughly dried by running them on a conveyor through an oven kept at 350 degrees F. Time of drying is four minutes. In spite of this oven drying the work would stain badly if left packed close together in a moist atmosphere or if the humidity were high.

We began to have considerable work returned for replating because of becoming stained, tarnished and discolored, this in spite of the fact that the parts had passed a rigid inspection and were o. k. when leaving the plating department. It appeared on parts packed and tested close together in trucks and boxes. Unlike a tarnish on silver plated articles which appears where air comes in contact with metal this was just reversed, where air circulated freely the cadmium plate was o. k. but where parts lay close together and air could not circulate we would have a sharp and distinct outline of the shape of the part in a dark brown stain or tarnish. This trouble sppeared mostly in hot humid weather.

We could not determine what caused this troublesome condition, so we had to discover some cure for it in order not to stop production. It was noted that parts which went directly into the assembly line never showed this discoloration, but it was impossile to put all immediately into the assembly line so they were piled as loosely as possible in trucks and boxes to allow air to circulate freely. It was rather inconvenient to pack and pile work loosely as our storage space was limited and we ran out of trucks and boxes.

We consulted Mr. Soderberg of the Udylite Process Company, who had been investigating this same condition and his explanation was that, as cadmium was susceptible to discoloration in the presence of ammonia, these stains were caused by ammonia generated in the plating solution and absorbed by the metal while it was being plated. When parts were packed immediately after coming from plating solution the ammonia was not removed from pores in metal. (Rough and porous steel seemed to stain more readily than smooth cold rolled stock.) As long as the air had a chance to circulate freely in and around the various parts we experienced no difficulty, but just as soon as parts were stored in moist, warm air they would discolor.

Working on the assumption that a protective film of some kind might prevent this discoloration, we tried a whale oil soap solution in final hot water rinse, but we had no success with that. Lacquering was not considered on account of soldering which had to be done while parts were being assembled. It seems that the condition spoken of does not exist in new plating solutions, at least we did not experience it until cadmium plating solutions were several years old.

We finally found a remedy in a certain potassium soap cleaner used on aluminum, tin and their alloys. This was used in the final hot water rinse at a strength of 1/8 ounce per gallon or just enough to give the water a light milky color. Just what action takes place to cause this particular soap to give results I have been unable to ascertain. We were satisfied that it gave results. The slight film it leaves on the work did not interfere with subsequent operations. After work passes through this hot soap water and then through dryer it has a clean and clear appearance and does not stain even when packed close together in boxes and trucks.

Our barrel units for cadmium plating are not full automatic but they handle small parts very efficiently and economically. Each unit is composed of six horizontal cylinders thirty inches long and twelve inches in diameter; the plating tank is large enough to acommodate the six cylinders at one time and contains 600 gallons of solution. Two water rinse tanks are located at one end of plating tank and each one accommodates one cylinder at a time, cylinder is put in gear and makes electrical contact when submerged in plating tank and also rotates when submerged in water rinse tank. Next in line to rinse tanks is loading and unloading stand. When unloading, the cylinder is uncovered and inverted, this drops load into chute conveying work to tote pans which transfer parts to dryer. Motor generator set is located at opposite end from loading and unloading stand. An electric hoist travels over the length of unit for raising and lowering cylinders.

All the cleaning and pickling is done in a separate unit over which a chain hoist travels on an I beam loop reaching the plating and driving equipment as well. All parts to be barrel plated are cleaned and pickled in perforated sheet steel baskets, riveted and welded together. Baskets of this type and construction give better service than the wire mesh baskets which usually pull apart long before they are worn out, especially when they carry heavy loads. I find these sheet steel baskets more economical than the ones made of acid resisting metal; they may have to be renewed oftener but the cost is so much less that it really pays. These baskets are used for handling both steel and brass parts before cadmium plating. For brass parts that are to be bright dipped we use perforated sheet aluminum baskets, transferring from steel baskets just before going into bright dip.

The cleaning and pickling of screws, bolts, nuts, washers and small parts fabricated in press room is as follows: They are loaded into sheet steel baskets 12 inches in diameter and 16 inches high, carrying as much as 100 pounds at one load, this size load is possible when a chain or electric hoist is used. Unless exceptionally free from grease and oil, all parts are washed in a tank of solvent or low grade kerosene; this I find is good practice as it gives a better and quicker job of cleaning and saves the first hot cleaner. After draining they are placed in the first or heavy duty hot cleaner. This is followed by a 50% muriatic acid pickle as some parts have a heavy scale and some are rusty.

After rinsing in cold water they pass into the second hot cleaner to remove any grease that might have been picked up in pickle, they are rinsed and placed in a storage tank containing a four ounce per gallon solution of sodium cyanide where they remain until ready to be loaded into plating barrels. The cadmium plating solutions were operated with approximately three ounce metal and eight ounce free cyanide per gallon until we started plating various springs, then we found it advisable to reduce the free cyanide content to about four ounces per gallon to avoid hydrogen embrittlement.

The pickling operation on springs is just as important. For our purpose we used a 10% sulphuric acid pickle containing six ounces Bichromate of soda per gallon. By using this pickle and keeping the free cyanide content down in plating solution we have had no trouble with hydrogen embrittlement on springs of various sizes and shapes both flat and spiral. Depending upon the condition of the springs we sometimes roll them in a barrel with sand or pumice stone to remove loose black smut which is sometimes left there by the pickle. Where time will permit, a soaking over night in a four ounce per gallon sodium cyanide solution will put them in condition to plate clean and white both inside and out. This to be used in placing of rolling or tumbling. (Applause).

CHAIRMAN SLATTERY: Is there any discussion of this paper?

MR. MEYER: May I ask Mr. Greenwald in connection with that warm cyanide dip that you use preceding the cadmium plating, what temperature is that operated at?

MR. GREENWALD: One hundred and ten degrees Fahrenheit.

MR. MEYER: Is that used continuously or do you use it, say, for a few months and then have to dump it?

MR. GREENWALD: We have to dump it occasionally.

MR. MEYER: Do you notice as you use it for some period of time that you begin to get a deposit on the work?

MR. GREENWALD: No, on the contrary, it comes out clearer. Where you get a deposit like that it might be what we found in the first tank. You get it in the first tank. It was always used with the direct current and we always got a clear surface.

MR. GUSTAF SODERBERG: Mr. Greenwald brought out one fact which is very important, namely, that we get so many different kinds of materials going through. We have sold some full automatics lately and you are always up against the price proposition to keep the size of the full automatics down to a very minimum to get the lowest price on them. It think sometimes the platers can help a great deal if they realize that you can't squeeze a full automatic so very far trying to make a full automatic with one minute alkaline cleaner and dip in acid, when it may work on the kind of work you happen to have right at the moment, but a little later you may get the worst grease condition. You may get a little more scale and you are very badly off. The cyanide dip prior to the plating operation, I think, has saved many situations and should never be left out of a full automatic machine. I know the platers are not generally buyers of full automatic machines, but they are the ones who are running into the trouble when we have it. Bigger and better full automatic machines are what I want to talk for at this moment. Thank you.

MR. GARTLAND: I would like to ask Mr. Greenwald the amount of deposits. Six minutes is the time limit. You get about two tenths.

MR. GREENWALD: From two to two and one-half per ten thousandths.

SPECIFICATIONS FOR CHEMICALS USED IN CLEANING METALS

By Edward B. Sanigar

The Electrodepositors' Technical Society (London, England) appointed a Standards Committee some time ago to consider specifications in electroplating work. In their report, recently made public (*J. Electrodepositors' Tech.* Soc. 8, Preprint No.

3, pages 10-12 (1933) it is stated that their work has fallen into three main sections. These, and the progress attained, are given as follows:

1. *Cleaning Chemicals.*

   The Committee has considered the various substances used for metal cleaning, and gives a report (see below for summary) intended to help the plater in selecting his materials.

2. *Liaison with the British Standards Institution.*

   Representatives of the Committee are sitting on three British Standards Institution sub-committees dealing with platers' chemicals (nickel salts and anodes, and cyanides), containers for acids, and electrochemical definitions. Good progress is reported in these fields but no report is made.

3. *Proposed Standardisation of Electrodeposits.*

   The Committee, after considering the possibility and advisability of formulating standards for electroplated coatings, feels that this matter requires much consideration before any decision can be reached, and they are not prepared to make any recommendation at present.

Report on Metal Cleaning Chemicals

It is pointed out that the purity of the material is usually not of prime importance when the substance is used for metal cleaning only, and that sometimes some of the impurities may be beneficial. For this reason the Committee has not formulated exact specifications except for Trichlorethylene. Attention is, however, drawn to the fact that low grade chemicals, though working satisfactorily, are uneconomical to buy since the price charged for them is usually in excess of that for the amount of desired chemical they contain.

The Committee, realizing that the plater requires to replenish his solutions with small amounts of chemicals from time to time has endeavored to recommend the most satisfactory grade of chemical for general purposes.

A timely word of advice is given to the plater, *viz.*, "The plater should remember that in substituting pure chemicals for lower grade ones, he may not get the same results unless he adds the necessary materials. Thus, pure caustic soda alone is not suitable for removing mineral grease. Some caustic soda contains a large proportion of carbonate which assists the cleaning action, and the plater should decide by enquiring the prices of the pure materials concerned, whether it is not more economical for him to make his solutions with these than with the lower grade chemicals. Caustic baths that have been worked for some time are often found to be superior, due to the formation of a little soap from the greases removed. They can, however, be artificially aged by boiling with a small quantity of animal fat."

Specifications are given for the following chemicals:—

1. *Caustic Soda*

The "Flake" or "Petal" Caustic Soda, 98% is considered the most economical, and should contain 97-98% NaOH. The principal impurities are sodium carbonate, sulfate and chloride, while silica and iron may also be present. Lower grades are not considered economical for cleaning solutions, nor is pure caustic soda (containing 99.5% NaOH), although this latter may be used for plating solutions.

If required for replenishing solutions it should be bought in containers that can be easily closed and made air-tight since it readily absorbs moisture from the atmosphere. The hundredweight drum of caustic soda (in which the caustic has been poured into the drum while molten and has solidified into a solid mass) is not considered serviceable in most instances.

2. *Sodium Carbonate* (*Soda ash*)

The grade called "light ash" is considered most suitable. This should contain about 57% Na_2O, the principal impurities being sodium bicarbonate and chloride, and iron. It is pointed out that soda crystals are not economical as they contain a large amount of water (of crystallization).

3. *Sodium Silicate.*

The grade containing about 30.5% SiO_2 and 9.5% Na_2O, with a density of 84° Twaddell is favored as being most economical and most easily handled.

4. *Sodium Phosphate* (*Trisodium Phosphate*)

The Committee found sodium phosphate ($Na_3PO_4.12H_2O$) apparently sold in one grade only, practically pure although small quantities of sodium chloride and sulfite may be present.

5. *Caustic Potash*

"Broken" potash is advised as being most easily handled and most generally suitable. This should contain about 89% KOH, the impurities being carbonate and chloride. Like caustic soda, it absorbs moisture and should be kept in air-tight containers.

6. *Potassium Carbonate*

This, it is stated, is usually supplied in a grade containing about

96-98% K_2CO_3, the principal impurities being potassium chloride and sulfate, and sodium carbonate.

7. *First Sorts English Potashes*; *American Potashes*

Of these, the report says "These two materials contain about 45% each of caustic potash and carbonate of potash, with some 10% caustic soda. This mixture is marketed in this form, and it is suitable for cleaning purposes."

8. *Trichlorethylene*

It is pointed out that trichlorethylene is finding increasing use in cleaning, especially by the vapor process, and that it is essential it be pure and, particularly, free from acid since otherwise the work will be etched. The following specification is suggested:-

Boiling range. — 85.5-87.5° C. (760 mms.).
Phosgene — Absent.
Specific gravity at 15° C. — 1.47-1.48.
Water content. — Less than 0.02%.
Acidity. — Not acid to Methyl Orange or Phenol Phthalein.
Color. — Free from all color.
Free Chlorine. — Absent.
Residue on evaporation. — Less than 0.001.

9. *Carbon Tetrachloride*

Carbon tetrachloride (CCl_4), apparently, is supplied in one grade, which should conform approximately to the specification given below:-

CCl_4. — 99.9%.
Sulfur compounds. — Less than 0.03%
Acidity. — Absent.
Moisture. — Absent.
Boiling point. — 76.8°C.
Specific gravity. — 1.600.

This completes the report. In presenting this summary to members of the American Electroplaters' Society it is felt that, not only will it be of interest to them to know what is being done by their sister society in England, but that it will be of value to them in their profession.

ABSTRACT SECTION

EDWARD B. SANIGAR

These abstracts are mostly adapted, by permission, from "Chemical Abstracts", the references to that publication being given in the form — *C. A.*, **27**, 3402 (1933) *i. e.*, Chemical Abstracts Volume 27, page 3402 in the year 1933. The name appearing at the end of the abstract is that of the abstractor. Abbreviations for scientific journals are those used by "Chemical Abstracts" (see *C. A.* **25**, 6019 (1931). E. B. S.

Use of bimetallic anodes in the electrodeposition of alloys. C. BECHARD. *Compt. rend.* **196**, 1480 (1933).—With brass anode and other conditions regulated to give a deposit rich in copper (about 80% Cu) the supply of copper from the brass anode does not compensate for the copper deposited. Because of so-called "bath inertia", the composition of the deposited alloy undergoes cyclic variations. The same phenomena are observed when separate copper and zinc anodes are used, but the variations in composition are much greater. In general, the amplitude of these variations is greater as the area ratio of anodes deviates from the metal ratio of the alloy most favorably deposited under other bath conditions. When the initial electrolyte is potassium cyanide, the first effect is the attacking of the copper and the zinc anodes in proportion to their relative exposed areas. The resulting concentration of the electrolyte then determines the composition of the alloy first deposited. Once a deposit of alloy occurs, the cyclic phenomena described above recur. The controlling interdependent variables are: (1) ratio of rate of solution of the anode metals, (2) composition of solution and (3) composition of alloy deposited.

C. A., **27**, 4176 (1933). R. H. CHERRY.

Coloring of copper and brass. M. GROSSIEAUX. *Cuivre et laiton* **6**, 35 (1933).—Several recipes for cleaning and pickling brass with sulfuric acid, or sulfuric with chromic acid, or nitric acid, or a mixture of sulfuric and nitric acid are given. Copper can be colored green ("patina") by an ordinary salt solution of 25 g./l. which is repeatedly applied to the surface until the desired color is obtained; the same effect can be brought about by a solution of 1 lb. ammonium chloride in about 20 liters of water. With a solution of 5 liters water (at 70°C.), 4-8g. potassium sulfide and 10 drops ammonia (26%), the metal assumes successively the tints brown, bronze-red, blue-black, black; the treatment is stopped when the desired tone is obtained. Blue or black on brass, according to the duration of immersion, is obtained in a solution of 5 liters of water (at 80° C.), 250g. sodium thiosulfate and 30-60g. lead acetate. Brass is also blackened by 68 parts of ammonia (specific gravity 0.91) and 10 parts basic copper carbonate in which solution the metal is vigorously moved about. Details of treatment are given.

C. A., **27**, 1599 (1933). M. HARTENHEIM.

Coloring brass with solutions. GEORG GROSS. *Metallwaren-Ind. u. Galvano-Tech.* **30**, 455 (1932).—Rolled brass strips containing 63% copper were treated with a solution of 124g. sodium thiosulfate ($NA_2S_2O_3.5H_2O$) and 38g.

lead acetate (Pb $(CH_3COO)_2.3H_2O$) dissolved in 1 liter of water. By variations in time and temperature there was produced almost the entire color scale.
C. A., **27**, 935 (1933). CURTIS L. WILSON.

Chromic acid poisoning. R. W. GRAHAM. *Can. Med. Assoc. J.* **27**, 645 (1932).—A patient engaged in chromium plating for 2½ years developed excessively troublesome cough and hoarseness. There was loss of sleep and weight with anorexia (loss of appetite. E.B.S.) and fatigue and nose bleeding. The nasal septum was perforated. Removal from the fumes, inhalations of Frair's balsam, free elimination from the bowels and bladder, together with an iron tonic, resulted in complete recovery.
C. A., **27**, 909 (1933). G. H. W. LUCAS.

The effect of hydrogen peroxide in the chromium-plating bath. E. RAUB and K. BIHLMAIER. *Mitt. Forschungsinst. Probieramt Edelmetalle* **6**, 85 (1932/33).—Experiments have shown that hydrogen peroxide can be used with advantage as an addition to chromium-plating baths in all cases where an increase in the content of chromic chromate is desired, as it reacts almost immediately with chromic acid to form chromic chromate. Chromic salt increases the range of bright chromium-plating as long as it does not exceed a certain amount with respect to the chromic acid. The best ratio of chromic acid to sulfuric acid does not greatly depend on the content of chromic chromate; the throwing power of baths very rich in chromic acid is greatly improved by increasing the sulfuric acid content to 1.5-2.2% of the chromic acid. The bath resistance is not perceptibly influenced by a content of chromic chromate up to 7-10% of the chromic acid. The test results are given in curves.
C. A., **27**, 1276 (1933). M. HARTENHEIM.

Protection of steel against corrosion by outdoor atmosphere by electroplating with nickel, chromium, and nickel plus chromium. P. JACQUET. *Bull. soc. franç. électriciens* **2**, 631 (1932); Chimie et industrie **28**, 1351.—The corrosion tests were carried out exclusively by exposure to atmospheric agents. The protection of the steel by electrolytic deposits of nickel became appreciable only above 700mg. nickel per sq. dm. (0.00032 inch thick). The method of applying the deposit did not seem to have much effect on the corrosion. Nickel deposited at low c.d., however, appeared to give slightly better protection than when deposited at high c.d. Chromium applied directly on steel up to a thickness of 0.0002 inch or 0.005mm. (340mg./sq.dm.) did not afford any protection. The protective action of nickel can be improved upon by covering it with a coating of chromium of suitable thickness which, in turn, depends on the thickness of the nickel coating; with less thn 500mg. nickel/sq. dm., the weight of the chromium should be at least 45mg. (equal, from the above figures, to approx. 0.000027 inch. E.B.S.). From the standpoint of appearance, polished nickel plus chromium is much superior to polished nickel alone. A coating of nickel+copper+chromium affords much better protection than nickel+chromium, but rapidly acquires an unsightly appearance, which may be avoided by using a coating of nickel+copper+nickel+chromium, which is the one most used at the present time. A coating of nickel+cadmium+chromium affords excellent protection against rust, but gives rise to a superficial scaling of chromium; nickel+cadmium+nickel+chromium coating is to be rejected for the same reason, and gives even worse results. (Compare this

abstract with the Tentative Conclusions published by The Research Committee, A.E.S. in The Monthly Review for January 1933, pages 5-9. E.B.S.).
C. A., **27**, 1276 (1933). A. PAPINEAU-COUTURE.

Chromium-plated culinary articles, cutlery, etc. German patent No. 567,307. December 18, 1930. Vereinigte Deutsche Nickel-Werke A.-G. vorm. Westfälisches Nickelwalzwerke Fleitmann, White and Co. The chromium layer is deposited on a layer of nickel-copper alloy containing more than 25%, preferably 45-70%, of nickel. The resistance of the chromium layer to acid foods is thus enhanced. *C. A.*, **27**, 1283 (1933).

Chromium-plating the bore of gun-barrels. U. S. patent No. 1,886,218. November 1, 1932. JOHN M. OLIN and ALFONS G. SCHURICHT (to Western Cartridge Co.). Chromium-plating is used for finishing gun-barrels, or for restoring the caliber of re-bored guns. Claim is made generally to gun-barrels with chromium-plated bore. Apparatus for plating is described.
C. A., **27**, 1283 (1933).

Chromium-plating. British patent No. 360,649. October 28, 1930. Siemens and Halske A.-G. A pre-determined degree of hardness is imparted to steel articles of large surface relative to mass, e. g., needles, by heating them, after chromium-plating, in non-oxidising, preferably liquid, media to 100-300° C. and then rapidly cooling. *C. A.*, **27**, 913 (1933).

Chromium-plating. German patent No. 563,882. January 13, 1927. I. G. Farbenind. A.-G. Chromium-plating to resist corrosion and heat is produced by giving a metal an intermediate nickel or cobalt coating, a final galvanic coating of chromium, and heating to a high temperature in a neutral atmosphere so that the two coatings diffuse into each other without melting. Temperatures between 1100-1300° C. are used. Examples are given.
C. A., **27**, 913 (1933).

Chromium-plating. U. S. patent No. 1,890,633. December 13, 1932. ELMER J. WALTZ. An electrolyte for chromium deposition contains chromic acid 18 oz. and sodium cyanide 1.5 oz. per gallon.
C. A., **27**, 1579 (1933).

Coating molded articles with metal. British patent No. 363,432. September 27, 1930. JOSEPH GLOSTER, LTD., and LEONARD J. GLOSTER. The article is molded from a mixture of a synthetic resin or phenol-formaldehyde condensation product (25-50%) and an electrically conductive material, e. g., carbon (50-75%), in a finely divided state, and a coating of metal is electrodeposited on the finished molding. *C. A.*, **27**, 1579 (1933).

Bath for electroplating with tungsten. U. S. patent No. 1, 885,701. November 1, 1932. COLIN G. FINK. A bath is used comprising an aqueous solution of tungstic acid and an alkali metal carbonate, such as sodium carbonate, and having a pH of about 12.5. U. S. patent 1,885,700 relates to a bath formed by adding tungstic acid and an alkali metal compound such as caustic soda to water so as to give a pH of about 12. U. S. patent 1,885,702 specifies adding a trace of nickel to an acueous tungstate plating bath, the nickel serving as a cathode depolariser. Apparatus is described. Thorium, titanium, zirconium or aluminum may be plated from similar baths.
C. A., **27**, 913 (1933).

Flexible razor blades with cutting edges of electrodeposited tungsten or cobalt-chromium alloy. British patent No. 348,336. April 12, 1930. C. H. HUMPHRIES. Various details of manufacture are given.

C. A., **27**, 1283 (1933).

The Eloxal process (anodic oxidation of aluminum). HANS SCHMITT. *Metallwirtschaft* 11, 689 (1932).—The Eloxal process consists of producing anodically an oxide coating on the surface of articles made of aluminum or aluminum alloys. The electrolyte consists of an oxalic acid solution with the addition of a strong mineral acid. By the proper choice of concentration of the solution, temperature, c. d. and voltage, the structure and properties of the oxide coating can be varied to suit several purposes. For wire, strip and foil an elastic film can be produced which will withstand bending and has good electrical insulating properties. If desired it can be made sufficiently porous to absorb Bakelite varnish, this resulting in high electrical resistance. A very hard coating can be produced which is used on screws, valves, gas cocks and hose couplings. Another application is for vessels which are to resist the corrosion of fruit juices and wine. For this purpose the vessels are sometimes impregnated with linseed oil and then baked. This type of coating has no effect on the flavor of the liquids. (See the Monthly Review for April 1933, page 47, for an article on "Alumilite", also a process for the anodic oxidation of aluminum. E.B.S.). *C. A.*, **27**, 908 (1933). C. E. MACFARLANE.

Surface protection of light metals. J. FEISER. *Umschau* **36**, 428 (1932); *Met. Abstracts* (in *Metals and Alloys*) **4**, 104.—After mention of paint coatings, galvanic coatings and mechanical plating, anodic oxidation is discussed, and attention is directed to the Eloxal method of the Vereinigte Aluminum Werke. The bath consists of oxalic and chromic acids. A film of 0.02-0.03 mm (0.0008-0.0012 inch) thickness is secured, the properties of which can be varied between a hard brittle oxide, almost as hard as corundum, or a less hard and elastic oxide. Stress is laid on the fact that the Eloxal layer is a perfect insulation. The chemical resistance can be improved by impregnating the film with paint coatings which may be any color. Aluminum pistons impregnated with fat did not display any noticeable sign of wear. Eloxal films show a greater resistance to wear than chromium-plated surfaces.

C. A., **27**, 4514 (1933). G. G.

Oxide layers on aluminum. French patent No. 736,918. May 10, 1932. Vereinigte Aluminum Werke A.-G. Layers of oxide are produced on aluminum or its alloys electrolytically, the electrolyte being projected, e. g., by a spray pistol, onto the object placed as the anode, the electrolyte being connected by appropriate means to the negative pole of the source of current.

C. A., **27**, 1285 (1933).

Oxide layers on aluminum. French patent No. 723,299. September 24, 1931. Vereinigte Aluminum Werke A.-G. Oxide layers on aluminum are made elestic by a treatment with alkaline solutions or solutions of salts of feebly alkaline or acid reaction, of potassium chlorate, potash alum, metallic soaps or wetting agents. *C. A.*, **26**, 4141 (1932).

The Bonderite process. FR. KOLKE. *Oberflächentech.* **10**, 127 (1933).—The Bonderite process is a method to produce quickly on iron or steel surfaces a phosphate layer which protects the metal from corrosion and which can be coated subsequently with paints, oils or other materials; the phosphate layer is produced to supply a better bond for the adherence of the coat. The objects to be bonderized are suspended for 8-12 minutes in a 3% solution of manganese phosphate and a copper salt at 98° C; the parts are then cleaned with water, dried and are ready for coating. An installation for treating automobile parts in great quantities is described. The corrosion resistance of bonderized iron can still be increased by heating the parts up to 300-350° C. While this process is mainly intended for a rapid production of the phosphate layer for a better adherence of the coating, it is not quite equivalent to the Atrament and Parkerizing processes which are intended to increase the corrosion resistance.

C. A., **27**, 3903 (1933). M. HARTENHEIM.

Phosphoric acid as derusting and rust-preventing agent. BÜTTNER. *Tek. Tid. Uppl. C, Kemi* **63**, 45 (1933).—The chemical reactions involved in the pickling of iron in phosphoric acid are discussed. The disadvantageous hydrogen generation which takes place has been practically eliminated by the use of a 3.5% soln. of *atromentol*. This new compound consists of a mixture of primary metal phosphates with a small but fixed, amount of phosphoric acid. *C. A.*, **27**, 4515 (1933). D. THUESEN.

Electrolytic deposition of zinc from acid solutions. HISASHI KIYOTA. *Mem. Coll. Sci. Kyoto Imp. Univ., Ser. A.*, **15**, 301 (1932).—Baths of zinc sulfate in a solution 0.1 *N.* with respect to free sulfuric acid, and in sodium sulfate solution 0.1 *N.* with respect to acetic acid were tested. A platinum dish was used as cathode and a platinum disk rotating at about 1500 r. p. m. as anode. Deposits from the sulfuric acid solution were not satisfactory. With the acetic acid bath smooth coatings were obtained. The acid concentration varied with the amount of zinc present as follows: 0.15-0.21 *N.* for 0.5g. zinc in 125cc. of solution, 0.21-0.27 *N.* for 0.3g. zinc, and 0.27-0.33 *N.* for 0.1g. zinc. Sodium sulfate and ammonium sulfate, when less than 0.15 *N.*, did not interfere. *C. A.*, **27**, 909 (1933). CURTIS L. WILSON.

Zinc and aluminum anode for the electrodeposition of zinc U. S. patent No. 1,888,202. November 15, 1932. ARTHUR K. GRAHAM (to Hanson-Van Winkle-Munning Co.). Anodes are formed containing zinc together with aluminum (suitable in the proportion of about 0.25-5%), which serves to reduce sludge formation and to improve operation in various other respects. (See Monthly Review, September 1933, page 38. E.B.S.).

C. A., **27**, 1283 (1933).

Zinc-Aluminum-Mercury anode for the electrodeposition of zinc. U. S. patent No. 1,887,841. November 15, 1932. GEORGE B. HOGABOOM (to Hanson-Van Winkle-Munning Co.). Zinc anodes which may contain less than 5% aluminum and less than 1% mercury are used. (See Monthly Review, September 1933, page 38. E.B.S.). *C. A.*, **27**, 1284 (1933).

Influence of pickling operations on the properties of steel. H. SUTTON. *Rolling Mill J.* **5**, 275 (1931); *Met. Abstracts* (*in Metals and Alloys*) **3**, 306.—The pickling of iron and steel usually produces brittleness. The changes in physical properties are attributed to the presence of absorbed hydrogen. The acid cleaning of low-and medium- carbon steels is not detrimental, and the brittleness produced is but temporary. In 10% sulfuric acid soln., or in an equivalent soln. of acid sodium sulfate ($NaHSO_4$), hydrochloric or hydrofluoric acids, the degree of brittleness increases also with temperature of pickling up to 122° F. This embrittling effect disappears gradually at room temperature and more rapidly at higher temperatures. A heat-treated nickel-chromium steel strip, however, displays very little brittleness after pickling. Electrolytic pickling in sulfuric acid soln. results in severe embrittlement, which disappears on heating to 212° F. Electrolytic pickling in caustic soda soln., sodium cyanide or a mixture of sodium carbonate and bicarbonate produces but a slight embrittlement. Cracks may develop during pickling in steels that have been subjected to strain and insufficiently annealed. The addition of 2% pyridine or quinoline to an acid pickling bath may reduce the embrittling considerably. Hydrogen brittleness may be imparted to steel by the operations of electroplating. This is a more permanent form of brittleness and requires more vigorous attention than does the brittleness resulting from acid pickling. *C. A.*, **27**, 1850 (1933).

Electrolytic cleaning of metals. U. S. patent No. 1,917,022. July 4, 1933. THOMAS E. DUNN (to Bullard Co.). Organic dirt is removed from metallic parts by subjecting them as anodes to electrolytic action in an alkaline electrolyte containing phosphate and metallic ions including lead, tin, zinc or cadmium which combine with the oil or grease in the dirt to form a metallic soap. *C. A.*, **27**, 4489 (1933).

Application, structural peculiarities, and properties of sprayed metal coatings. H. REININGER. *Metallwaren-Ind. u. Galvano-Tech.* **31**, 89, 110, 130, 174, 194, 213 (1933); cf *C. A.*, **27**, 3179 (See below. E.B.S.).—As the adherence of the coating depends entirely upon adhesion without alloying, sprayed metals should be applied on surfaces roughened by either sand blast or pickling; surfaces already rough, such as cast iron, brass castings, cardboard, porous ceramic ware and wood, are immediately suitable. The microstructure is characterised by heaps of metallic grains, 0.01 - 0.15mm. in diameter, which have solidified from the molten state. Only in the case of low-melting metals like lead and tin is the heat of bombardment sufficient to remelt the metal layer. Adherence of the heaps is due not to welding but to surfaces pressing against each other. Pores and oxide layers are noted. Sprayed layers of tin, zinc, bronze, brass, aluminum, lead and copper are less dense than even the molten metals. Dense layers are obtained by light rolling or buffing with a steel brush. Annealing likewise improves the density and the covering and adhering properties. *C. A.*, **27**, 4515 (1933). CURTIS L. WILSON.

The essential characteristics of sprayed metal coatings. H. REININGER. *Z. Metallkunde* **25**, 42,71 (1933).—A brief review of the production and usefulness of sprayed metal coatings. The characteristics of various sprayed coatings are briefly described, and their structure illustrated by low-magnification photographs. *C. A.*, **27**, 3179 (1933). R.F.M.

The anodic behaviour of cobalt. KONRAD GEORGI. *Z. Elektrochem.* **39**, 209 (1933).—The influence of c.d., anion, pH, and temperature on the anodic behaviour of cobalt was investigated, and is compared with the corresponding measurements of nickel (See following abstract E.B.S.). The anion of the electrolyte has a strong influence on the passive state of cobalt, as with nickel, the potential increasing with the size of the anion for the same solution rate. No definite relation exists between c.d. and current yield of cobalt-ions. Passivity increases with pH, but temperature shows no analogous effect. Müller's theory of passivity applies to cobalt, with the assumption of a superoxide film at low c.d. *C. A.*, **27**, 4486 (1933). ALLEN S. SMITH.

The anodic behaviour of nickel. K. GEORGI. *Z. Elektrochem.* **38**, 681 and 714 (1932).—From a comprehensive study of nickel anodes in *N* solns of nickel chloride, bromide, sulfate, perchlorate and phosphate ($Ni(H_2PO_4)_2$) at various pH values and temperatures, and with various surface conditions, it is concluded that the theory of Müller (cf. *C. A.* **26**, 3171 (1932)) applies, together with the assumption of a saturation current or a superoxide film. *C. A.*, **26**, 5853 (1932). CURTIS L. WILSON.

Metal ribbons. French patent No. 746,154. May 23, 1933. Allgemeine Elektricitäts-Ges. Ribbons of metal, particularly iron, are made by depositing electrolytically a layer of the metal on a horizontal cylinder rotating in a bath in which it forms the cathode, the ribbon being continuously removed from the cylinder and passing out of the bath. *C. A.*, **27**, 4179 (1933).

Electrolytic production of ductile iron. U. S. patent No. 1,912,430. June 6, 1933. JOHN R. CAIN (to Richardson Co.). Iron is electroplated on a cathode from an anode comprising free iron, through an electrolyte of ferrous chloride rich in iron, and the pH of the electrolyte is maintained at 1.5 - 2.5 by adding hydrochloric acid as required during the process, the electrolyte being maintained at a temperature of 95-100°C. *C. A.*, **27**, 4179 (1933).

Thin plates of iron by the electrolytic method. Japanese patent No. 93,615. November 17, 1931. KEITI YOSIDA. A soln. of ferrous chloride and sodium chloride is electrolysed with iron as anode and metallic tin or a tin alloy as cathode. During the procedure, ferric chloride is added or chlorine gas is passed in. *C. A.*, **27**, 1284 (1933).

ABSTRACTS FROM THE EDUCATIONAL COMMITTEE

MR. T. F. SLATTERY, Chairman

The Nature of Spongy Zinc Deposits obtained by the Electrolysis of Aqueous Solutions of Zinc Sulphate — W. S. Selborn. Transaction of the Faraday Society, Vol. 29-page 825 - 1933

Experimental evidence is presented to show that the formation of spongy zinc during the electrolysis of the sulphate bath is linked up with the production of zinc hydroxide at the cathode. The hydroxide is occluded in the deposit, retarding crystal growth spongy deposits are favored by low metal iron concentration and by high current density.

Influence of the Composition and Acidity of the Electrolyte on the Characteristics of Nickel Deposits — D. J. MacNaughton, G. E. Gardam, and R. A. F. Hammond. Trans. of the Faraday Society July 1933, page 729.

In a previous paper on the "Causes and Prevention of Pitting in Electrodeposited Nickel", * pitting was shown to be due to the screening effect of bubbles of hydrogen adhering to the cathode surface. It may be caused either by surface defects in the basis metal or by some condition in the solution. Pitting in highly purified solutions was studied to observe the effect of variations in the composition and pH on the hardness, microstructure, cathode efficiency, and appearance of deposits.

(*P. J. MacNaughton and A. W. Hothersall. Trans. of the Faraday Society, Vol. 24-page 497-1928).

Solutions of nickel sulfate (240g/l) in various combinations with boric acid (30g/l) and quarter normal concentrations of potassium and chloride ions were used. Thin deposits were made for visual inspection, and thick ones for hardness tests and study for microstructure. For solutions not containing chlorides, the anode was surrounded by a porous pot containing solution with nickel hydroxide in suspension. Cathodes were sheet copper, coated with 0.005″ copper deposited from an acid copper bath to cover over any surface defects. The solutions were used first at high pH, after which the pH was successively reduced by additions of sulphuric acid. The cathode current density was 11 amp per sq. ft., and the time of deposit two hours, giving a thickness of 0.0015″. The cathode efficiency was measured in each run using a copper coulometer. Thick deposits were made only from solutions containing boric acid, on cathodes of hexagon mild steel rods coated with 0.001″ copper. The pH measurements were colorimetric, but these were corrected to correspond to the quinhydrone electrode reading.

The buffer characteristics of the various solutions, and the changes in cathode efficiency and surface appearance with pH changes are shown by charts and graphs. In general, deposits from buffered solutions (those containing boric acid), had a matte finish, while those from unbuffered solutions tended to be lustrous or streaky, though in all cases, sound matte deposits were obtained at the lowest pH values investigated. Cathode efficiency curves show that buffered solutions are the more efficient at a given pH, and that the efficiency falls off more rapidly in unbuffered than in buffered solutions. Hardness tests showed a decrease in hardness with decrease in pH to a critical pH value. For solutions containing chlorides, further decrease had little effect. Maximum and minimum points occurred in graphs for solutions free from chlorides. In general, hard deposits were small-grained and tended to be bright, becoming larger grained and matte as hardness diminished. The presence of basic material in the deposits suggests that variations in the tendency for basic material to form with change of pH in the solution is similar to variations in hardness. This basic material is of a colloid nature and is positively charged. Thus it migrates to the cathode and is included on the crystal faces, restraining crystal growth and causing fine grained, hard deposits. The effect of the various ions on this tendency is discussed.

Pitting was observed in certain pH ranges in spite of the use of pure materials, and the copper coating on cathodes used to eliminate "basis metal pitting." Contrary to previous reports and to popular assumption, pitting was absent below pH3.0 and tended to occur in the high pH range of solutions containing boric acid and potassium chlorides, such as are in general use. Though a large number of bubbles form at low pH these detach quickly and do not cause pits. Quicker growth of these bubbles, and the agitation caused by their rise helps to account for this condition. Basic material of neutral charge consisting of flocculated colloids in the cathode film is apparently a large factor in determining whether or not the bubbles adhere and cause pits. The fact that potassium ions, and also those of sodium and lithium, reduce pitting where it otherwise occurs, while ammonium and magnesium ions have no effect corroborates this view. Chloride ions, on the other hand, stimulate pitting because of their strong deflocculating effect.

BRANCH NEWS

DETROIT BRANCH

IMPORTANT CONVENTION NEWS

The meeting of October 6, 1933 was held in the Hotel Statler. Mr. Hansjosten presiding. The minutes of the September meeting were read and approved. The report of the Committee for Date and Location of the 1934 Convention of the Supreme Society was read and accepted. It was found that the only available dates open in Detroit are June 11, 12, 13 and 14; and the location is the Statler Hotel. The Rotary Club of America have one week before the 4th and the Red Arrow Division of the Legion the other week. As the 4th falls on Wednesday that week is out entirely. We wrote the Supreme Secretary regarding these dates and in order to comply with the Constitution there will be a referendum vote taken by all the Branch Societies of A.E.S. Our secretary was instructed to write the Supreme Secretary advising that if these dates are not acceptable the Convention cannot be held in Detroit in 1934. It is therefore very urgent that the Branches take quick action on the referendum as there are other Societies anxious for these dates.

The Question Box only contained a few questions as follows:

1.—*Is vapor degreasing practical for cleaning before plating die castings?*

Ans.—Yes.

2.—*Some information of process for anodic treatment of aluminum?*

Ans.—Write the Aluminum Co. of America; also Aluminum Color Corp., Indianapolis.

3.—*Kindly have the Secretary read and interpret Article 7, section 3 of our Constitution.*

Ans.—The interpretation is plain. Anyone who can read may understand it. It seems to be the opinion of the Delegates from Detroit to the Rochester Convention that this section was voted down and has been put in the Constitution by error.

The meeting was well attended and a fine spirit of enthusiasm shown for a successful winter program as well as a successful Convention. Although the Branch can do no more work on it until a referendum vote has been taken therefore it requests the Branches to take this vote promptly. Detroit Branch is confident that if it has the Convention it will prove as successful as the one held here five years ago.

T. C. EICHSTAEDT, *Sec'y*

WATERBURY BRANCH

Waterbury Branch opened its Fall and Winter program Friday, October 13th. with a review of the most interesting topics discussed at the Chicago Convention. Delegates Wm. Delage and Wm. Guilfoyle gave an account of the proceedings at the Convention. Considerable stress was laid on the work of the Research Bureau and the condition of its treasury. A communication from Supreme President Van Derau calling attention to the necessity for quick action in the securing of more funds if the work of the Bureau was to continue, was read and after a little discussion the consensus of opinion was that the work of the Bureau, or at

least that part now under way should be continued and in order to its willingness to cooperate voted to indorse the suggestion of Supreme President Van Derau that each member of the A.E.S. contribute one dollar to the fund and accordingly voted to donate $39.00 to the Research Fund.

The Committee on Speakers reported that for the next meeting, which takes place Friday, November 10th, the services of Philip H. Kirby, research associate of the American Brass Corporation had been secured. Mr. Kirby's subject will be one of great interest to platers, chemists and all interested in up-to-date finishing.

W. F. GUILFOYLE, *Sec'y*

ROCHESTER BRANCH

Rochester Branch held it's regular monthly meeting at the Hotel Seneca on Friday night, September 15. Meeting called to order by President Kohlmeier. Minutes of the previous meeting were read and approved as read.

The picnic committee consisting of C. Reama as chairman, Chas. Hehr and G. A. Lux reported that the picnic would be held at Ellison Park on Saturday, September 30 and said that a large turnout was expected. Geo. Scobell of the Scobell Chemical Co. then offered to donate the "hots" and rolls for the picnic. His offer was accepted with thanks. There were no other reports of committees.

The Question box was then opened and these questions were found:—

What causes acid copper to streak?

Ans.—Mr. Cameron—There are different types of streaks such as streaks which are uniform in the deposit; straight streaks and round streaks and these are all direct indications of different current conditions.

Mr. Gartlant—What really causes the streak? No doubt you have seen as the deposit keeps building up the streak keeps getting deeper and deeper?

Mr. Scobell—Will ridge keep building up?

Mr. Gartlant—No, the metal keeps building up around the streak.

Mr. Desmond—Do you get these streaks on all metals?

Mr. Gartlant—No, only steel. There is no known cause for these streaks even if bath is agitated it will not eliminate streaks. The only way we have found so far to eliminate streaking is to use fewer anodes in the bath.

Mr. Lux—Would dirty work cause streaks?

Mr. Reama—Yes; but it also appears on absolutely clean work.

Mr. Cameron—A streak will appear on any metal.

Mr. Lux—Where a point has a larger current density doesn't it explain treeing or streaking?

Mr. Desmond—When does streaking begin? At first or later?

Mr. Gartland—Right away. We found we got the nicest deposit on glass at 32 degrees F.

Mr. Desmond—If by reducing the anode surface this condition is somewhat eliminated then evidently the anode current density has something to do with this condition.

Mr. Cameron—New solution does not streak, it may tree but it does not streak. The streak is a developed contion. Any outside dirt does not affect the solution.

Mr. Cameron—Only remedy is to keep the solution filtered and this is not a complete remedy.

Mr. Hehr—Another way to overcome it is to work the solution for some time at a high current density.

Question—*Is there an anode that will give a better throwing power to your chrome solution than 6% antimony lead?*

Ans.—Mr. Kohlmeier—Yes. A 7% tin-lead does not build up a lead

chromate as much as 6% antimony lead.

Mr. Desmond—The bath, that is it's condition, has more effect on the throwing power than has the anode.

After this discussion the meeting was adjourned.

JUDSON R. ELSTER, *Secretary.*

CHICAGO BRANCH

The regular monthly meeting of Chicago Branch was held October 14 at the Atlantic Hotel. President E. G. Stenberg presiding and all other officers present. The application of C. C. Johnson was balloted on and Mr. Johnson elected an active member. An application received from V. S. Brouse read and committee appointed on same. A letter from our National President Mr. Van Derau in regard to research, also the reply read and approved. Mr. Gilbertson brought up the matter of a class in chemistry for this year and Mr. Faint offered to get in touch with Mr. Emery the teacher and report at our next meeting. The convention chairman Mr. F. J. Hanlon read the final report on the convention. Receipts $4,619.67. Disbursements $4,122.05. Balance $497.62, which was turned over to the general fund of the Chicago Branch. The committee was then dismissed by our President E. G. Stenberg and given a vote of thanks by the entire branch for the excellent work done by them. The meeting was then turned over to our Librarian who found the following questions in the question box.

Q. 1. Will Sodium Stannate dissolve in water, if not what will dissolve it?

Ans. It will dissolve in water.

Q. 2. Can a steel tank be used for a chrome tank?

Ans. Yes. if it is heated with steam coil but heating with gas usually caused the bottom to leak.

Q. 3. Can small steel parts be blued in a barrel, if so what solution is used?

Ans. Many suggestions were offered but this is usually done by rolling in a hot sand barrel at about 550°. Another member stated that he was doing it in a steel drum heated by gas.

Q. 4. Wanted. An immersion electrolytic solution to give a good black on etched Aluminum sheets, other than black nickel or the patented dye anodic treatment.

Ans. Many suggestions offered, but no definite answer given.

J. W. HANLON, *Secy.*

ANDERSON BRANCH

Meeting called to order by the President.

Mr. Cleaver reported for the Committee on Trade Publications. The committee selected "Metal Industries" (London) and "OBERFLACHEN TECHNIK" as two publications the Branch should subscribe to in furtherance of its educational program. Action sanctioned. Mr. Minton reported for the Program Committee. In addition to its educational sessions, the Committee suggested that visits to several neighboring plants be arranged for the benefit of the members. This suggestion was enthusiastically received and Messrs. Chaney, G. S. Cole and Onksen were appointed as a committee of three to assist the Program Committee in arranging these plant visits.

A general discussion followed on means of increasing the attendance at the regular meetings. Mr. Ralph Seabury suggested that some subjects of general interest, not too technical, be presented. Also that two notices of each meeting be sent to each member, these suggestions are to be followed.

At the close of the business meeting, Mr. Ralph Seabury gave a very interesting talk on the History of Chemistry, outlining the earliest discoveries and uses of some of our commonest present-day chemicals.

G. M. COLE, *Secy.*

NEWARK BRANCH

The Newark Branch opened its Fall and Winter sessions with a bang on September 15th with a talk on Coloring of Steel by Oliver Sizelove. It was never better presented. Explaining the different rust-proof finishes such as Parkerizing, Carbona, Bar Bar and the nitrate method. The meeting was very well attended having 38 members present.

At the October 6th meeting George Hogaboom spoke on the test plates conducted by the Research Associates at Washington, D. C.

The Newark Branch arranged a trip to Sandy Hook to view the test plates there on Saturday, September 30th.

Mr. Hogaboom had with him a splendid group of samples of test plates sent him by Dr. Blum from the other locations where the test plates were exposed. It was indeed interesting to those that attended the Sandy Hook trip to view the effects of the climatic conditions at these different places. Mr. Hogaboom's talk was enlightening and brought forth many questions.

After Mr. Hogaboom's talk our Supreme President's letter was read and after some discussion it was decided to take a voluntary collection which netted a total of $27.00 and Newark Branch went on record for continuing the research work.

George Reuter, *Secy-Treas.*

BRIDGEPORT BRANCH

The Regular Meeting of the Bridgeport Branch was held in the Chamber of Commerce rooms of the Stratfield Hotel on October 6. President Al Rosenthal called the meeting to order at 8 p. m. The Sick Committee had no report and there were no applications for membership. A communication in regard to the Research Fund was read and handed over to Ray O'Conner, as was the communication regarding the Code. The Speakers Committee has selected Mr. Hogaboom to be the speaker at the next open meeting on Friday November 3 in the Stratfield Hotel, The Outing Committee made a report on the most successful Outing on September 23. The treasurer's report was read and accepted, and all bills were ordered signed and paid. The meeting adjourned at 10 p. m.

Wm. Flaherty, *Secretary.*

ST. LOUIS BRANCH

Regular meeting of St. Louis Branch was called to order by President Bartt. Roll call of Officers showed two absent. Minutes of the previous meeting were read and approved. A letter was read from our Editor on advertising in the Review. Mr. Williams reported on the progress he had made in having Dr. Stout with us again this year. His report was very favorable. Our members can look forward to some real live meetings which will be very Educational by our Librarian F. P. Mennings. Chas. T. McGuiley, *Secy.*

HARTFORD-CONNECTICUT VALLEY BRANCH

The Hartford-Connecticut Valley Branch, held its first fall meeting on Monday evening, Sept. 25, 1933. Past President Mr. Beloin took charge of the meeting. Minutes of the previous meeting were read and accepted. All communications were tabled until the next meeting, also bills for the first quarter per capita tax and Convention Report were tabled due to lack of funds.

There was no speaker for the evening. There was an attendance of only six members. Most of the time was spent in discussing means of larger attendance and renewed interest.

There was much discussion as to why no answer had been received from Pres. C. E. Van Derau, in connection with our petition of last June.

V. E. Grant, *Sec'y.*

MILWAUKEE BRANCH

The regular meeting of Milwaukee Branch was held at Lipps Hall, N. 3rd and W. Highland Ave., October 12, 1933.

The meeting was called to order by President Paul Krause and was well attended. After the regular business the educational meeting was held, with Assistant Librarian Edw. Werner in charge. The topic for the evening was Electric Pickle. Mr. Pat. Sheehan who was on the educational committee gave a very interesting talk.

FRANK J. MARX, *Sec'y.*

CLEVELAND BRANCH

The Cleveland Branch held its regular monthly meeting Saturday October 7th, 1933, at Carter Hotel.

The meeting was called to order a 8.15 p. m. with President Ter Doest in the chair.

The minutes of the previous meeting were read and approved.

All bills were voted paid. Communication read from supreme President Van Derau with regard to the continuation of the research work. The Cleveland Branch is in favor of continuation of this work. but at the present time is unable to offer any financial aid.

We received the application of John H. Shope, 4416 W. 58th St. Cleveland, Ohio and suspended J. B. Heargeist and Thos. Sweeney.

Mr. Thompson our Librarian gave a demonstration of a cleaning compound and showed samples of this work. The meeting adjourned at 10.30 P. M.

W. D. SCOTT, *Sec'y.*

HARTFORD-CONNECTICUT VALLEY BRANCH

The Hartford-Conn. Valley Branch held its regular monthly meeting on Monday evening, October 23, 1933 at the Hartford Chamber of Commerce, 805 Main St., Hartford, Conn.

The meeting was called to order at 8.30 P. M. with Past President Beloin in the chair. The minutes of the previous meeting were read and approved. All communications were read and placed on file. One bill amounting to three dollars and twenty-two cents, ($3.22) for copy of Convention Proceedings was voted paid.

The Secretary was instructed to send a special letter to President Van Derau, requesting an answer to our communication in regards to our petition made last June, within a period of ten days.

Considerable time was spent in discussing ways and means of making our meetings more interesting, so as to be able to draw a larger attendance to the meetings. We promise something quite different for the next meeting.

Meeting was attended by only ten members and was adjourned at 10.00 P. M.

V. E. GRANT, *Sec'y*

APPLICATIONS

	Branch
Lester R. Horner, 307 W. Washington St., Alexandria, Ind.	Anderson
V. S. Brouse, 7911 Elmgrove Drive, Elmwood Park, Chicago, Ill.	Chicago
Howard A. Krumerud, c/o E. R. Squibb & Sons, New Brunswick, N.J.	Newark
Cyril Hamlin, 123 Seymour Ave., Newark, N. J.	Newark

ELECTIONS

C. C. Johnson, 1124 Kern St., Waterloo, Ia.	Chicago

RE-INSTATEMENTS

Oscar Kuntz, 6519 Barlum Ave., Detroit, Mich.	Detroit

DEATHS

Harry Flanigan, died Sept 27. Newark

RESIGNATIONS

Grand Rapids—John Van Daff.
Toronto—W. E. Redfern

SUSPENSIONS

Boston—Wm. A. Laurence, Frederick English. *Philadelphia*—R. Hoenstein, M. A. Berenato, A. M. Moore, E. Ohl, W. L. Schaffer, H. C. Simmons, M. Smith, H. G. Trout. *Toledo*—S. C. Bogner. *Toronto*—E. Coles. *Cleveland*—J. B. Heargeist, Thos. Sweeney. *Newark*—L. Fowler, G. E. Miller, L. Steeber, G. F. Carlson, C. Bohler, A. Muller, F. Rickenshauser, D. Davis, H. Wait, M. Sternbach. *Chicago*—E. L. Ingram.

BOOK REVIEW

Die Galvanotechnik (Electrodeposition) by Gerhard Elssner.

Published by Akademische Verlagsgesllschaft, Leipzig, Germany. 1933 (448 pages). (Price at present exchange about $10.00).

It may seem strange to discuss in the Review of the American Electroplaters' Society, a book published in German, a language which few American platers can read. However, those platers who can read German, and all chemists interested in plating, will find this a very interesting and valuable book.

It forms part 3 of the first volume of a "Handbook of Electrochemistry", edited by Victor Engelhardt. Naturally therefore the book is more scientific than most of the other books on plating that have, been written in English or German. In fact its greatest value will be to one engaged in research, for it contains over 500 references to papers on deposition, including many American authors. These references are especially complete on methods of measuring throwing power, and the hardness, adherence and protective value of plated coatings.

The book also contains descriptions and illustrations of apparatus used in cleaning and plating. This section gives a good opportunity to compare the mechanical progress in Germany and America.

The extensive scope of the book has made the treatment of many subjects so concise that it may not be as valuable to the practical plater as to the chemist who has access to other books and journals. For example the methods of analysis are described so briefly, that only a chemist could follow them.

The author has succeeded in his effort to bring to persons engaged in electrodeposition a complete, critical, concise summary of the scientific principles and developments in this field. W. BLUM.

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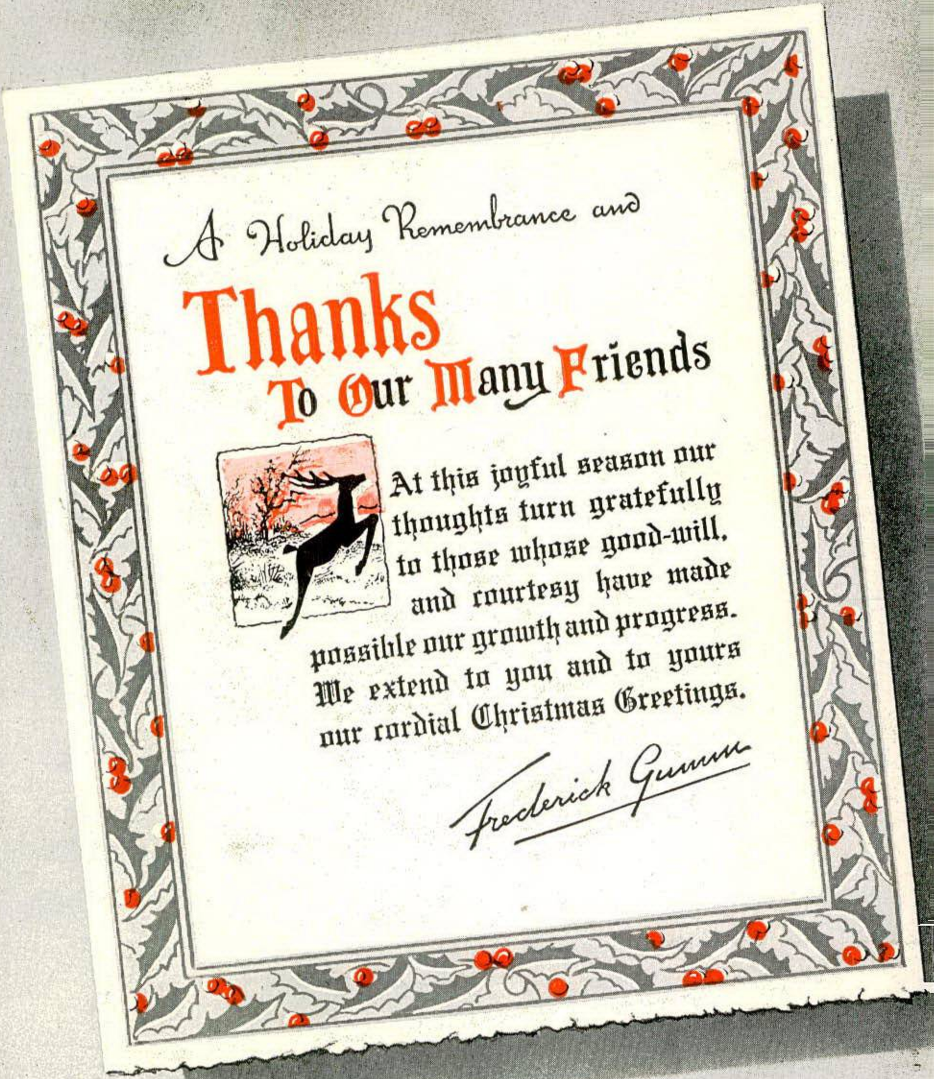
Merry Christmas

DECEMBER · · · 1947



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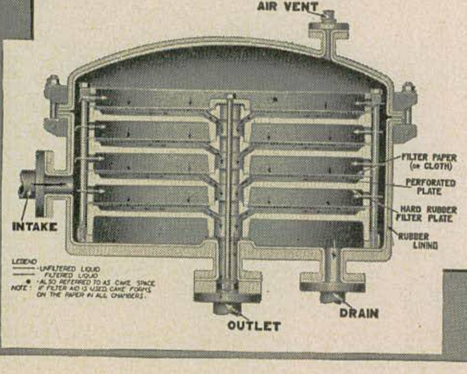
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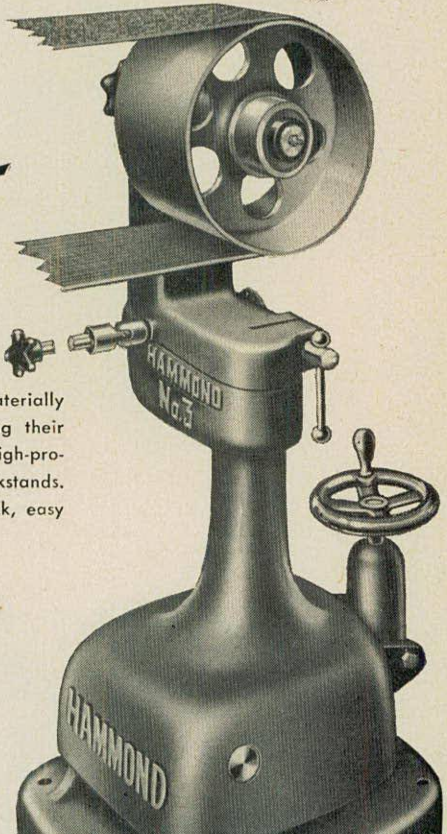

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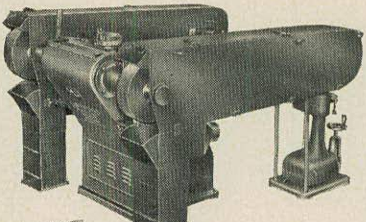

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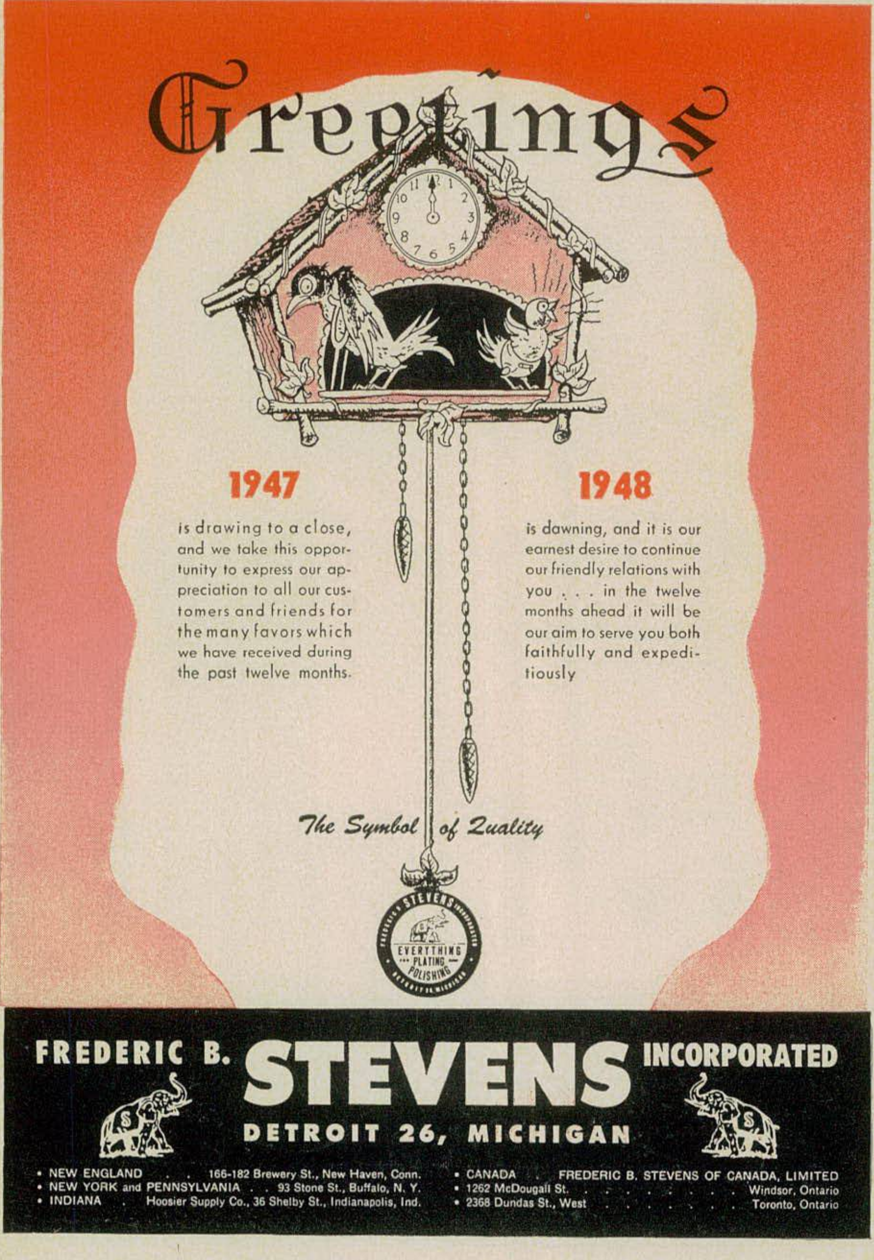

THE MONTHLY Review

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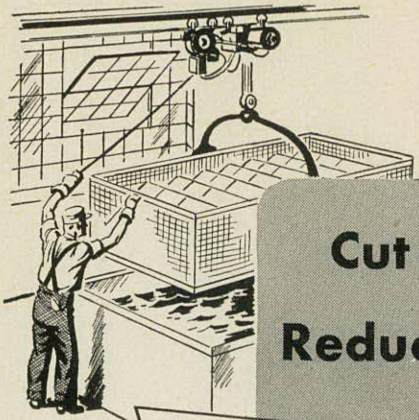

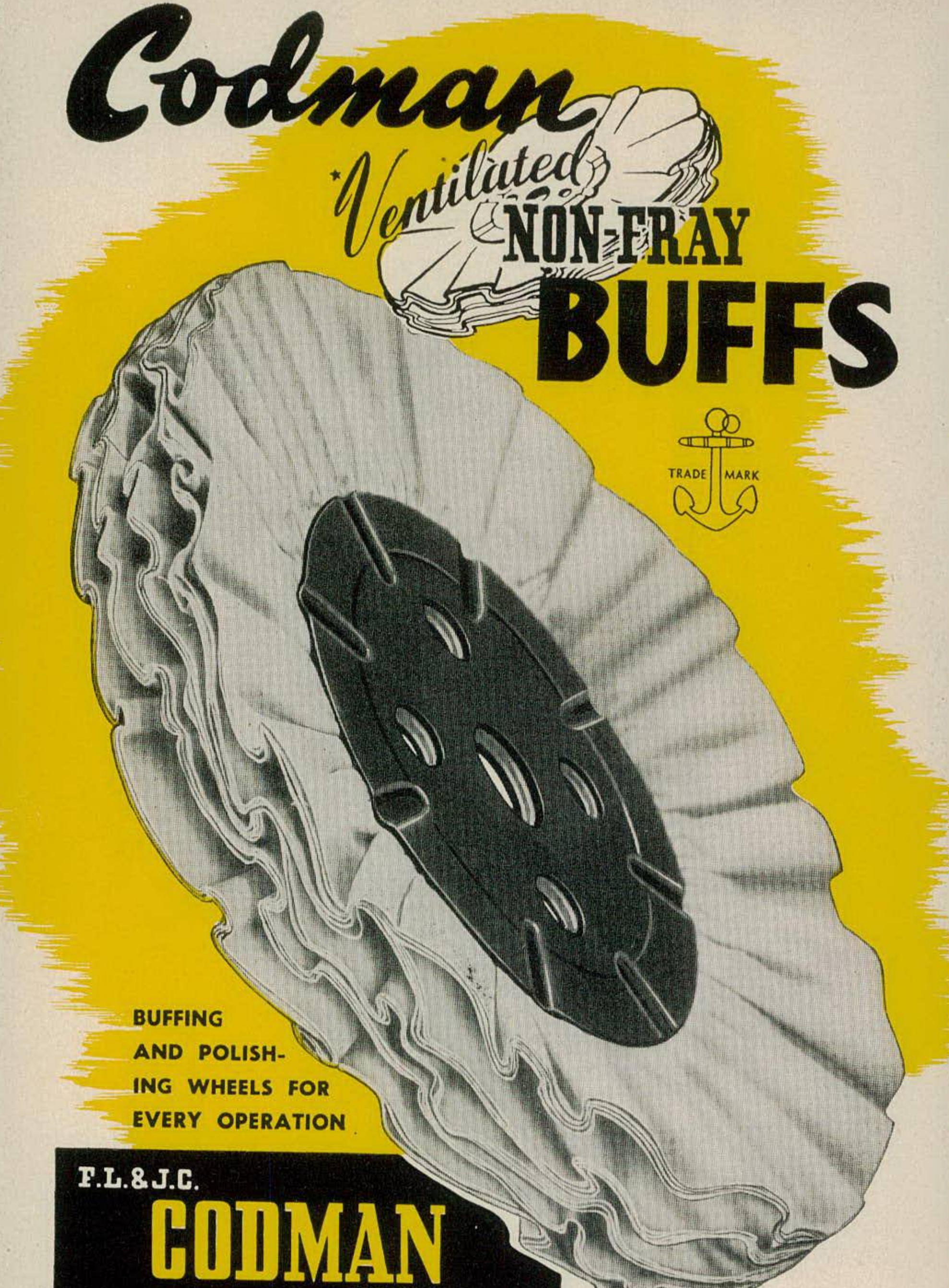

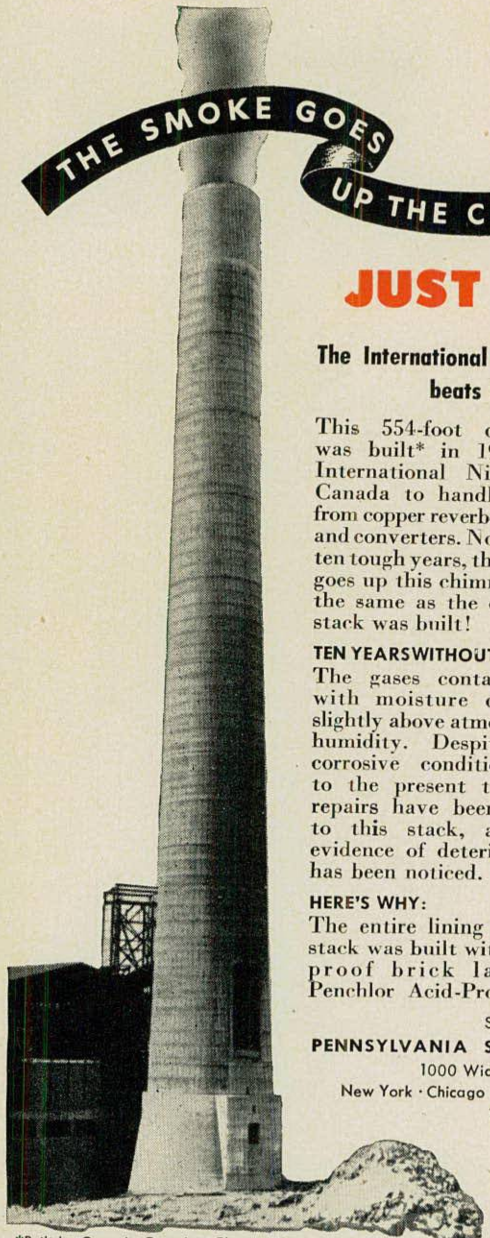

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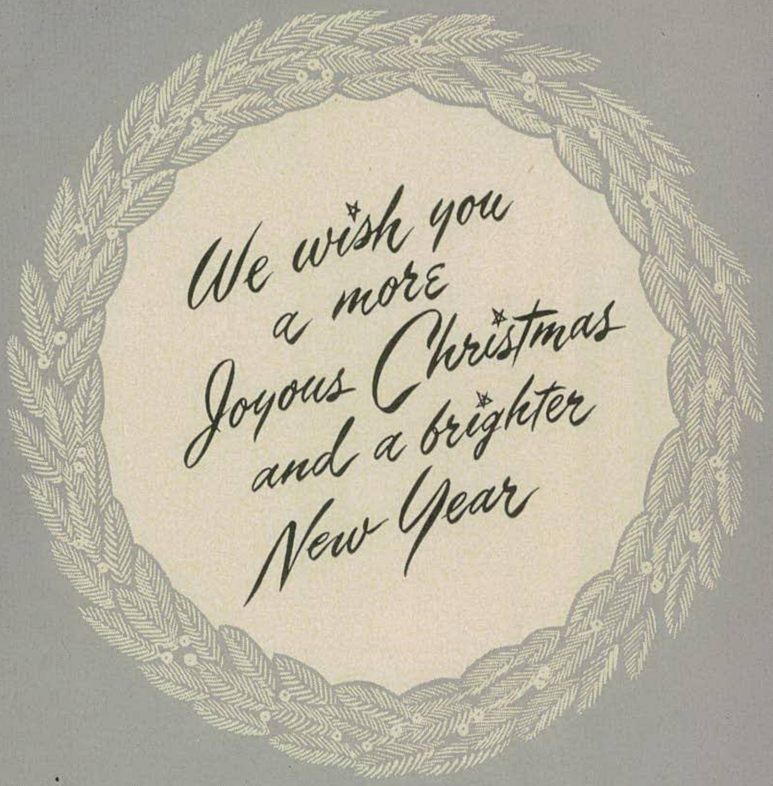
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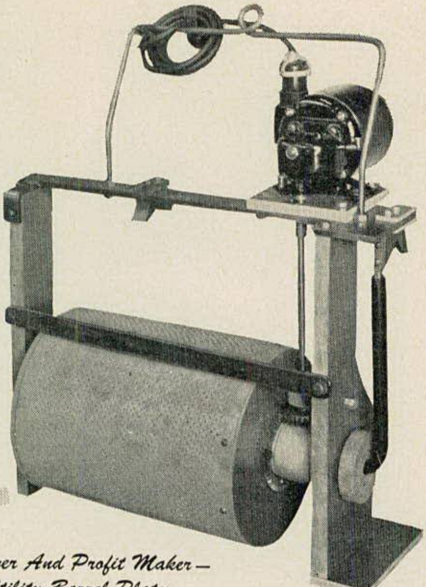

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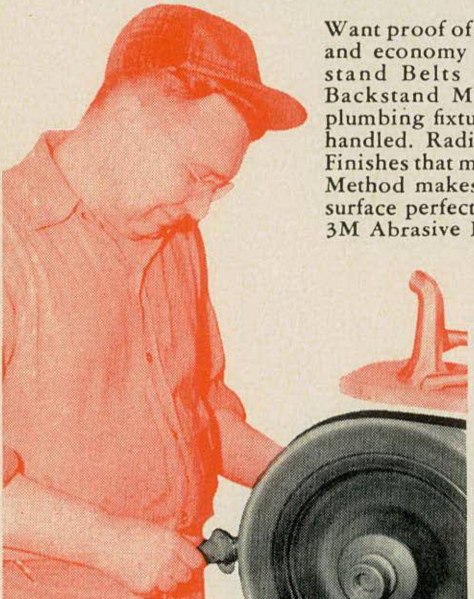

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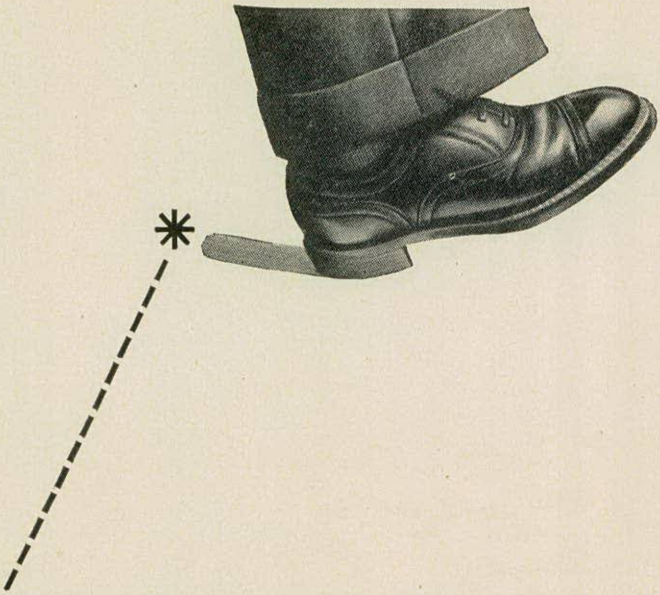

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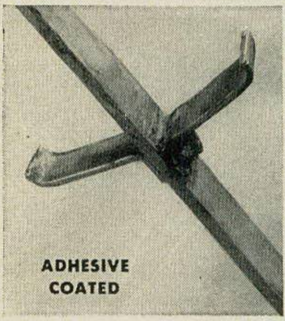
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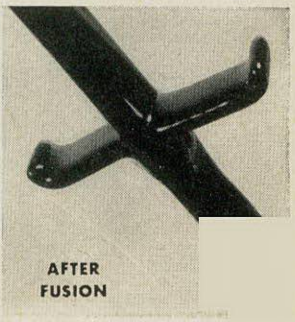
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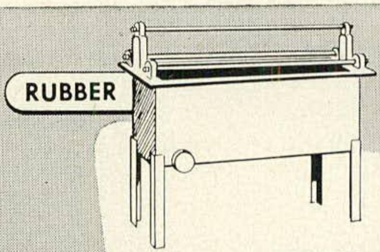
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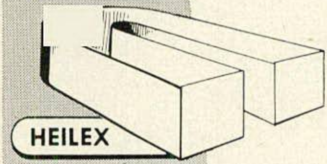
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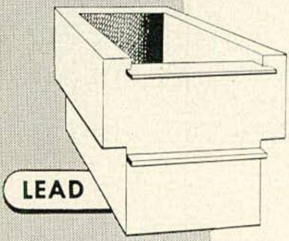
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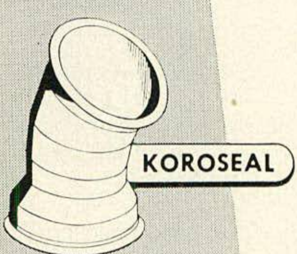
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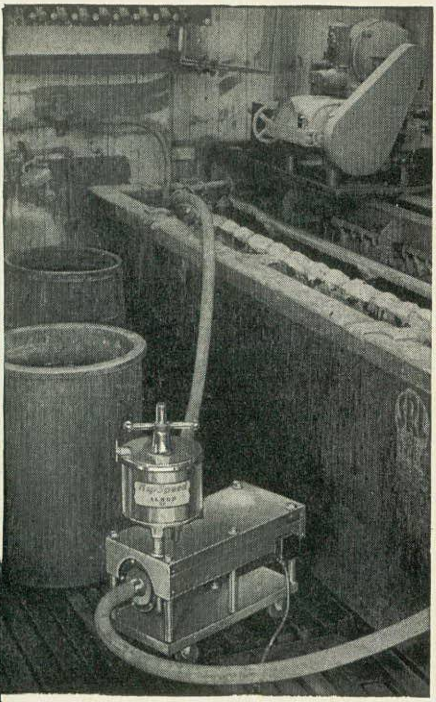


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THE MONTHLY Review

EDITORIAL

Branch Exhibits at the Industrial Finishing Exposition

For almost seven years of war and reconversion the work of the Exhibits Committees has been beset by a multitude of difficulties. The membership is fully aware of the many problems which were faced during that time, and that, in spite of them, exhibits of interest and educational value were collected.

By this time, the plating industry has set its house in order and is again producing the many plated and finished parts which had practically disappeared from the market. Many methods and processes developed during the war are still being used without change, or in only slightly modified form for the production of peacetime articles. For these reasons the members of the Society should again put forth an all-out effort to display their handiwork.

Since the manufacturers of plating and allied equipment and supplies will exhibit the tools with which platers and finishers do their work, it is particularly fitting that the latter get together and show what they can accomplish by combining these tools and their own ingenuity.

The Exhibits Committee urges every member to prepare actively to push toward the goal it has set up: "An Exhibit from Every Branch."

The Branch secretaries will be notified of the details very soon. It is the Committee's earnest wish that Branch Committees be organized to see to it that the many interesting results of their members' craftsmanship be displayed.

WM. NEILL,
Exhibits Chairman.


THE CARRIAGE-MAKER
Was Good
IN HIS DAY

FATIGUE LIMIT OF CHROMIUM PLATED STEEL

LOUIS MEHR, T. T. OBERG, AND J. TERES

Materials Laboratory, Air Materiel Command
Army Air Forces, Wright Field, Dayton, Ohio

THIS ARTICLE HAS BEEN PREPARED FROM A LABORATORY REPORT, RELEASED FOR PUBLICATION THROUGH THE COURTESY OF THE MATERIALS LABORATORY AND OF THE BUREAU OF PUBLIC RELATIONS, WAR DEPARTMENT.

SUMMARY

A survey of the literature of chromium plating and its effect on fatigue resistance has shown wide discrepancies. The information was limited in detail and quantity.

The purpose of this investigation was twofold:

(a) A systematic study and evaluation of the effect of the possible variables on the fatigue limit.

(b) The development of a process which would cause such a low fatigue loss that the necessity for testing each plated part could be dispensed with. This latter objective was not completely realized, but several desirable conditions were established.

The minimum reduction in fatigue strength for chromium plating to 0.001 inch in thickness without the use of nitriding was approximately 8%. Reductions as high as 50% for 0.001 inch thick coatings were found under unfavorable conditions.

The optimum conditions for high fatigue strength were found with plate applied at 55° C (131° F) in the upper end of the bright plating range. The least favorable condition was obtained at low current densities in the 70° C (158° F) bath. In general, at a particular temperature, the higher the current density, the less is the reduction in fatigue properties, and the lower the current density, the greater is the reduction.

Baking after plating to remove hydrogen embrittlement reduced the fatigue limit in a number of instances. Similar effects have been reported by Wiegand and Scheinost.[1]

A treatment prior to plating may have a profound effect. Beneficial results were obtained by nitriding the steel prior to plating, but electrolytic polishing produced a marked decrease in the fatigue limit of the steel.

All coatings tested in this investigation were deposited from the conventional dilute chromic acid bath containing 250 g/l chromic acid and 0.25 g/l sulfate ion.

It is concluded that chromium plate cannot be applied indiscriminately to highly stressed areas subject to vibration. Since stresses in aircraft parts are indeterminate in most applications, each application of chromium plate should undergo a model test with a sufficient number of cycles to demonstrate its serviceability. Satisfactory completion of 30 million cycles is normally taken as insurance that the part is not operating above the fatigue limit. It is obvious that maximum plate thickness should be used in this evaluation. The number of cycles may be reduced provided it exceeds the maximum position of the knee of the S-N curve of the particular steel in the condition in which it is plated.

REPRESENTATIVE EARLIER FATIGUE WORK

Fatigue data on chromium plated steel were collected covering earlier work done at Wright Field on specimens plated by various laboratories. To these were added data compiled from other sources. The following information was available:

SAE 4140 Steel

Source: Plating by Ford Motor Company, fatigue tests at Wright Field

Rockwell C Hardness Prior to Plating—33

Cleaning Procedure: Alkaline electrocleaning followed by a hot water rinse and then a 20-second anodic etch in 32 oz/gal chromic acid (CrO_3) at 1.7 ampere per square inch (asi)

Plating Procedure: Plating while bar is revolving for 45 minutes in a bath consisting of 24.8 oz/gal chromic acid (CrO_3) plus 1.6 oz/gal of 35% hydrofluosilicic acid, followed by a rinse in hot water to removed adhering solution

Fatigue Test: Reversed bending in R. R. Moore rotating beam fatigue machine at 10,600 rpm

SAE 4640 Steel

Source: Plating at Wright Field

Rockwell C Hardness Prior to Plating—36

Cleaning Procedure: Organic solvent cleaning to remove grease film; anodic etching at plating current density

Plating Procedure: Fixture placed in center of geometric square made by anodes. Parts plated at 26 ± 1° C (79 ± 2° F) in 300 g/l (40 oz/gal) chromic acid (CrO_3) plus 3 g/l (0.4 oz/gal) of sulfuric acid (H_2SO_4), then rinsed in hot water. Plating conditions were such that a gray plate was obtained which duplicated the appearance of the plate on gray-chrome plated propellers

Fatigue Test: Reversed bending in R. R. Moore rotating beam fatigue machine at 3450 rpm

4340 Steel

Source: Plating by Battelle Memorial Institute, fatigue tests at Wright Field

Hardness Prior to Plating: Not available

Cleaning Procedure: Electrolytic polishing, details not obtained

Plating Procedure: Not obtained

Fatigue Test: Reversed bending in R. R. Moore rotating beam fatigue machine at 3450 rpm

SAE 6130 Steel

Source: Plating by National Bureau of Standards, fatigue tests at Naval Air Experimental Station

Rockwell C Hardness Prior to Plating—33

Cleaning Procedure: Anodic etch

Plating Procedure: Plate was applied from a bath of 33.0 to 37.0 oz/gal chromic acid (CrO_3) and 0.33 to 0.37 oz/gal sulfuric acid (H_2SO_4) at 65° C (149° F)

Fatigue Test: Reversed bending in R. R. Moore rotating beam fatigue machine

SAE 4340 Steel

Source: Plating by Van der Horst with the porous plate process, fatigue evaluation at Wright Field

Rockwell C Hardness Prior to Plating—32

Cleaning Procedure: Gasoline to remove grease film. Etching in CrO_3 solution for 30 seconds at 2 asi

Plating Procedure: Plating in 25 oz/gal of chromic acid (CrO_3) and 0.25 oz/gal of sulfuric acid (H_2SO_4), immediately followed by polarity reversal and the same current density to produce the porous effect. The bath temperature was probably 50° C (122° F).

Fatigue Test: In R. R. Moore rotating beam machine at 3450 rpm

SAE 4130 Steel

Source: Plating and testing by Naval Air Experimental Station (two series)

Rockwell C Hardness Prior to Plating—35

Cleaning Procedure: Anodic etch

Plating Procedure: Coatings were applied either at 1.4 asi and 55° C (131° F), or at 7.0 asi and 70° C (158° F) in a solution of 33.0 to 37.0 oz/gal of chromic acid (CrO_3) and 0.33 to 0.37 oz/gal of sulfuric acid (H_2SO_4)

Cr–Ni–Mo–V Steel

Source: H. Wiegand and R. Scheinost[1]

Hardness Prior to Plating: Not available

Cleaning Procedure: Not available

Plating Procedure: Plate applied at 3.2 asi and 50° C (122° F)

Fatigue Test: Probably rotating beam type

The results of this earlier work are shown in Table I.

TABLE I

Results of Earlier Fatigue Work on Chromium Plated Steel

Steel SAE No.	Plate Thickness 0.00001 in.	Current Density, asi	Post Plate Treatment	Fatigue Limit psi
4140	None	....	....	77,000
4140	97	About 1.7	205° C, 3 hr	65,000
4640	None	....	....	82,000
4640	30	0.53	None	64,000
4640	200	3.1	None	18,000
4640	30	0.53	316° C, 4 hr	73,000
4640	200	3.1	316° C, 4 hr	30,000
4340*	None	....	....	78,000
4340*	120	Probably 2.5–3.0	None	33,000
4340†	None	....	....	74,000
4340†	230	2	Current reversal	48.000
4340†	460	2	Current reversal	50 000
4340†	460	2	Current reversal 290° C, 3 hr	46,000
6130	None	....	....	65,000
6130	15	7.0	None	38,000
6130	45	7.0	None	41,000
4130	None	....	....	86,000
4130	10–20	1.4	None	74,000
4130	30–45	1.4	None	65,000
4130	200–300	1.4	None	77,000
4130	30–45	7.0	None	56,000
4130	100–200	7.0	Polished	76,000
4130	200	7.0	None	30,000
4130	200–300	7.0	None	28,000
4130	920–1100	7.0	None	40,000
4130	1500	7.0	None	35,000
4130	None	....	....	86,000
4130	50	1.8	None	80,000
4130	50	7.0	None	49,000
Cr–Ni–Mo–V	None	....	....	74,000
Cr–Ni–Mo–V	160	3.2	None	68,000
Cr–Ni–Mo–V	590	3.2	None	64,000
Cr–Ni–Mo–V	160	3.2	250° C, 2 hr	62,000
Cr–Ni–Mo–V	790	3.2	250° C, 2 hr	31,000

*Plated by Battelle. †Plated by Van der Horst.

It is evident that the plate thickness is not the only variable affecting the fatigue limit of the steel. The divergence in the nature of the steels and the pre-plating and plating conditions from those in our own tests will be shown to have had a drastic effect upon the fatigue limit.

PLAN OF INVESTIGATION

The following variables were investigated:

(a) Plating temperature as it affects current density range, hardness of plate and loss of fatigue strength.

(b) Baking and baking time in their effect

TABLE II

Physical Properties of the SAE 4340 Steel

Property	Specimen No.		Average
	1	2	
Tensile Strength, psi	148,300	148,900	148,600
Yield Strength at 0.2% offset, psi	137,000	138,000	137,500
Elongation, %	19.0	19.0	19.0
Reduction of Area, %	58.0	58.5	58.2
Brinell Hardness, 3000 kg load	311	312	311
Izod Impact Strength, ft-lb	63, 66, 69	64.5, 65.6, 67	65.8

on loss in fatigue strength, on hardness and crack frequency.

(c) Current density at a particular bath temperature as it bears on loss in fatigue strength and on crack frequency.

(d) Nitriding of the steel in relation to notch sensitivity and loss in fatigue strength.

(e) Size of fatigue specimen.

The following factors were not investigated: Composition and hardness of the steel, composition of the chromium plating bath.

EXPERIMENTAL

History of the Steel

The materials used in the portion of this investigation dealing with fatigue were 1½ inch round bars made from SAE 4340 chromium-nickel-molybdenum steel. The mill analysis for the material was furnished by the manufacturer as follows:

C	Si	Mn	P	S	Cr	Ni	Mo
0.39	0.24	0.72	0.018	0.016	0.82	1.76	0.25

The physical properties of the steel were determined with standard tensile and Izod impact specimens and with stock bars in accordance with Federal Specification QQ-M-151a. They are listed in Table II.

Preparation of Fatigue Specimens

Approximately 175 standard R. R. Moore fatigue specimens of a diameter of 0.300 inch were prepared, also 24 specimens of a diameter of 0.800 inch. The fatigue specimens were rough machined within 1/16 inch of the finished dimensions and heat treated to a Rockwell C hardness of 32–34, then machined to the required finished dimensions. They were super-polished longitudinally to remove surface irregularities.

Nitriding

Approximately 60 fatigue specimens were subjected to nitriding in a Homo furnace for 43 hours at a temperature of 510° C (950° F) with ammonia gas as the hardening agent.

Included during the nitriding operation was a special rectangular test specimen which was used for a hardness survey of the nitrided case. The block was tapered after nitriding at a rate of 0.0266 inch in depth for every inch of length until the core was reached, and hardness values were taken every 0.0125 inch along the taper (representing successive penetrations of 0.0033 inch) by means of a Vicker's hardness testing machine with a 10 kg load. The data in Table III shows the values obtained.

V-Notched Specimens

The gauge sections of several of the polished specimens were given a 60 degree circular groove, 0.0025 inch deep, with a

TABLE III
Hardness of Nitrided Case

Case Depth inch	VPN Hardness 10 kg load
0.0000	560
0.0033	525
0.0066	506
0.0099	503
0.0132	413
0.0165	405
0.0198	390
0.0231	369
0.0264	369
0.0297	369
0.0330	351
0.0363	351
0.0396	345
Core	311

0.010 inch radius at the bottom. About half of this group was nitrided along with the unnotched specimens. The purpose of notching the specimens was to determine the notch sensitivity of the steel when nitrided and unnitrided.

Hardness and Crack Evaluation Specimens

Approximately 150 SAE 1020 steel tube specimens of ⅜ inch OD, ¼ inch ID and ½ inch height were prepared.

Plating Procedures

The cathode fixture was composed of a group of five *fatigue test specimens* with a suitable copper strap to permit clamping onto the cathodic bus-bar. The specimens were internally threaded at each end and were held tightly together by means of stud bolts. The terminal fatigue specimens were dummies which were used to facilitate even current distribution on the middle three test specimens. A photograph of the fixture is included as Fig. 1.

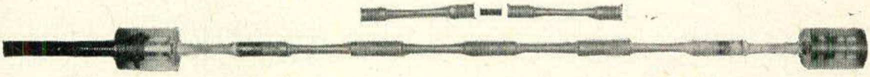

Fig. 1. Cathode plating fixture with transparent insulating ends. Fatigue specimens fastened together with ¼ inch, 20-thread studs

The fixture for plating the *hardness-and-crack evaluation* specimens consisted of a rod with threaded areas and nuts for holding the specimens as described below. An L-bend was made in the top of the fixture to facilitate clamping onto the cathode bus-bar. A group of 20 specimens was strung on the rod with a 2-inch long blank at each end. The specimens were brought into very close contact by means of nuts and were formed into a smooth-surfaced pseudo-cylinder by careful alignment to minimize the build-up of plate on the specimen edges.

The anode fixture consisted of four 7% antimonial lead anodes suspended from the anodic bus-bars to form the sides of an approximately 17-inch square. The cathode fixture was suspended in such a manner as to occupy the geometric center of the square.

The fatigue test and hardness-and-crack evaluation specimens were vapor degreased to remove corrosion preventive grease before insertion into the plating bath. They were then subjected to a 45-second anodic etch at the plating current density and temperature in the plating bath. This had previously been found to be essential to guarantee maximum adhesion. At the end of the 45 seconds the current was quickly reversed and plating was begun.

The plating was accomplished in the dilute chromic-sulfuric acid bath having a composition of 250 g/l chromic acid and 2.5 g/l sulfate ion. The ratio of chromic acid to sulfate ion was maintained at approximately 100/1. The plating was performed at two different bath temperatures, 55 ± 1° C (131 ± 2° F) and 70 ± 1° C (158 ± 2° F) with constant air agitation. The baths will be identified as the high and the low temperature bath respectively.

At the low bath temperature, specimens were plated at the following current densities: 0.71, 2.1, and 6.3 asi. At the high bath temperature, specimens were plated at the following current densities: 5.0, 8.6 and 13.0 asi.

The area of the five specimens that comprised the fixture, less the area of the ends of the dummy specimens which were stopped off, was 25.39 sq. in. The average current density over the entire area was determined by dividing the applied current by the area. After the completion of a plating run, the dummy specimens were stripped of their plate in a dilute hydrochloric acid pickle and re-used for the same purpose. They were discarded when pitting of the base metal became evident.

The current densities chosen were determined by the bright plating range which falls between 0.9 and 3.0 asi at 55° C and between 4.6 and 13.7 asi at 70° C. In the case of the high temperature bath, the three current density values used actually represented the high, median and low portions of the bright range.

The current density values employed in the low temperature bath approximately represented the lower limit and median of the bright range whereas the high current density value, 6.3 asi, was well above the upper limit of the bright range. Consequently the plate applied at this current density was nodular and slightly gray. The surfaces of these particular specimens were ground and polished to a smooth finish leaving approximately 0.003 inch of chromium plate.

At the time the low temperature bath specimens were being plated, the bright range data was incomplete and the 0.71 asi and 2.1 asi values were estimates of the lower and median current density values. The 0.71 value is slightly low. All plating and bright range data determinations were made at Wright Field.

The plate thickness on the test specimens was determined by magnetic methods. The instrument was frequently calibrated against standard specimens and found to be accurate.

Post Plating Treatment

To determine the effect of baking on the fatigue limit of the chromium plated steel, duplicate sets of specimens of about the same plate thickness were subjected to an air-bake at 205° C (401° F) for sixteen hours. The specimens were placed in the oven immediately following the plating, washing and drying operation.

Fatigue Limit Determination

The fatigue tests were made in rotating beam fatigue machines at an operating speed of 3450 rpm. All fatigue values were calculated on the basis of the overall plated diameters. A photograph of a fatigue specimen section after failure is included as Fig. 2.

The fatigue limit for specimens plated under a particular set of conditions was determined from the plot of stress versus the logarithm of the number of cycles (or stress reversals) to which each specimen was subjected. If a specimen withstood approximately 20 million cycles or more, the stress was considered to be at the fatigue limit or lower.

Each fatigue value was established by test on at least 5 specimens except in one instance when 3 were employed.

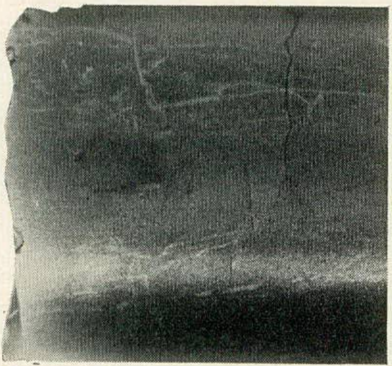

Fig. 2. Typical fatigue failure in chromium plated specimens with 0.002 inch thick chromium plate. Note fatigue cracks outside fracture

Hardness and Crack Evaluation

Specimens for the evaluation of hardness and cracks in the chromium plate were divided into six groups of 20 each. One group was plated at the lower limit, one at the median and one at the upper limit of the bright current density range for each of the two bath temperature conditions. Pairs of plated specimens of each of the groups were air-baked for time intervals of 2, 6 and 16 hours at temperatures of 205° C, 316° C and 427° C, respectively. The baking treatment accounted for 18 specimens from each of the groups. The two remaining specimens from each group were left unbaked.

The hardness indentations were made on a cross-section of the plate rather than on the cylindrical surface. This gave a more accurate reading since the chromium plate itself was used as a backing rather than the comparatively soft steel core. An Eberbach micro-hardness testing machine with a diamond indentor and a 100 gram load was used in the hardness determinations.

The thickness of plate varied from 0.0021 to 0.004 inch. A magnification of 1500X and a field diameter of 0.004 inch were used

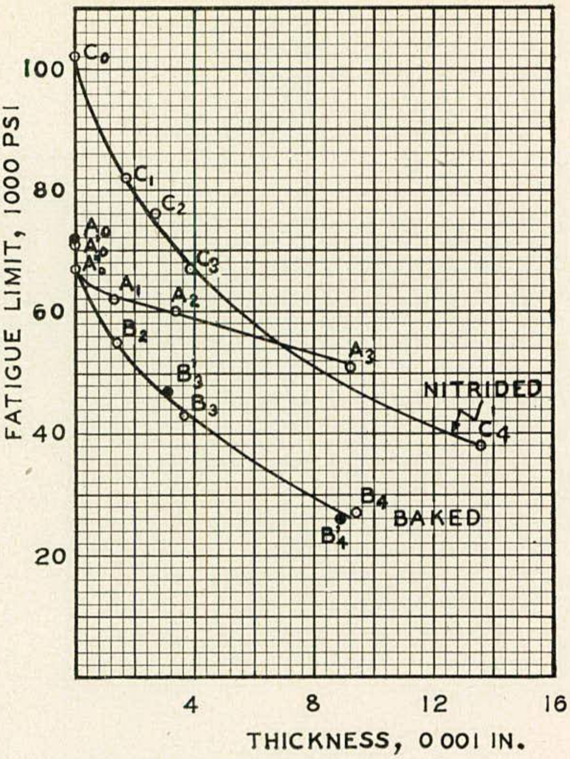

Fig. 3. Effect of plate thickness, nitriding before plating, and baking after plating on the fatigue strength of superfinished SAE 4340 steel, bright chromium plated at 55° C (131° F) and median current density of 2.1 asi

in the hardness determinations. Approximately five hardness indentations and readings were made on each specimen. The readings were made by two operators, and an average of their results was used. The values are believed to be accurate within ± 25 Eberbach VPN.

The number and nature of the cracks observed in the chromium plate per field of view were observed during the hardness evaluation. The crack count was made at 100X magnification and with a field diameter of 0.02 inch.

RESULTS

The results of the fatigue tests are shown in Tables IV and V and, in condensed form, in Figs. 3, 4 and 5.

The findings relative to crack formation, porosity and hardness are summarized in Table VI and Figs. 6 and 7.

Discussion of Results

Although a large number of tests were performed, only some variables were studied and those only within narrow limits. Hence any conclusions must be limited in scope, and one must guard against considering them of general validity.

In all cases, chromium plating lowered the fatigue resistance of the SAE 4340 steel. Part of the drop was caused by the etching of the steel (compare A''_0 with A_0) which is required to assure adhesion.

The results pictured in Figs. 3 and 4 were all obtained with chromium plating at current densities approximately in the middle of the bright plating range. With a plating temperature of 55° C (131° F), the fatigue limit was decreased as the thickness of chromium was increased, independently of whether the steel was plated directly and

TABLE IV

Fatigue Resistance of Chromium Plated, Superfinished SAE 4340 Chromium-Nickel-Molybdenum Steel

Diameter of specimens 0.300 inch except where noted.
Etching when used is for 45 seconds with specimen as anode in the plating solution.
Baking when used is for 16 hours at 205° C (400° F).
F indicates failure of specimen.

Designation	Chromium Thickness 0.00001 in.	Applied Stress 1000 psi	No. of 1000 cycles
Unplated specimens			
A_0	None	80F	252
A_0	None	80F	280
A_0	None	74F	345
A_0	None	72F	266
A_0	None	72	20,300
A_0	None	71F	497
A_0	None	71	25,500
A_0	None	70	25,000
A_0	None	70	20,000
A_0	None	70	20,200
Unplated 0.800 in. dia. specimens			
A'_0	None	100F	58
A'_0	None	90F	164
A'_0	None	74F	617
A'_0	None	72	20,000
A'_0	None	70	20,000
Unplated etched specimens			
A''_0	None	72F	519
A''_0	None	70F	460
A''_0	None	68F	1,089
A''_0	None	68	26,000
Etched specimens plated at 55°C (131°F), 2.1 asi			
A_1	143	65F	195
A_1	140	63F	214
A_1	135	62	19,750
A_1	129	62	20,500
A_1	130	62	21,500
A_2	345	62F	630
A_2	330	61F	232
A_2	340	61	24,000
A_2	330	60	21,200
A_2	335	60	25,600
A_3	940	65F	70
A_3	980	58F	987
A_3	940	55F	117
A_3	960	53F	255
A_3	960	51	25,300
A_3	940	50	10,000
Etched specimens, plated at 55° C (131° F), 0.71 asi, baked			
B_1	198	65F	101
B_1	198	50F	440
B_1	198	48F	997
B_1	195	47	22,000
B_1	193	47	20,000
B_1	193	46	19,500
Etched specimens, plated at 55° C (131° F), 2.1 asi baked			
B_2	135	65F	164
B_2	138	60F	352
B_2	133	58F	328
B_2	135	56F	950
B_2	140	55	21,500
B_2	140	55	21,340
B_3	380	65F	68
B_3	375	50F	166
B_3	490	45F	313
B_3	365	43	21,300
B_3	375	42	22,000
B_4	960	53F	70
B_4	940	40F	109
B_4	960	35F	162
B_4	960	30F	200
B_4	940	27	21,000
Etched 0.800 in. dia. specimens, plated at 55° C (131° F), 2.1 asi, baked			
B'_3	300	70F	105
B'_3	330	60F	153
B'_3	350	51F	367
B'_3	300	49F	538
B'_3	320	47	30,000
B'_4	850	50F	343
B'_4	850	38F	537
B'_4	1100	28F	555
B'_4	890	26	20,000
B'_4	890	24	20,000
Etched specimens, plated at 55° C (131° F), 6.3 asi, baked			
B_5	340	62F	220
B_5	330	60F	229
B_5	360	57F	219
B_5	310	57F	566
B_5	330	55	25,250
Unplated nitrided specimens			
C_0	None	115F	98
C_0	None	110F	332
C_0	None	105F	1,638
C_0	None	105F	4,108
C_0	None	103F	3,360
C_0	None	102	30,500
C_0	None	101	20,000

TABLE IV continued

Nitrided and etched specimens, plated at 55° C (131° F), 2.1 asi

Designation	Chromium Thickness 0.00001 in.	Applied Stress 1000 psi	No. of 1000 cycles
C_1	150	105F	38
C_1	175	100F	58
C_1	215	96F	188
C_1	200	92F	142
C_1	245	88F	152
C_1	175	82	5,000
C_2	275	85F	146
C_2	275	82F	175
C_2	220	79F	333
C_2	210	78F	158
C_2	210	76	20,000
C_2	275	76	25,000
C_3	390	98F	10
C_3	385	70F	760
C_3	385	67	10,000
C_4	1440	76F	10
C_4	1500	60F	38
C_4	1440	40F	509
C_4	1360	38	20,000
C_4	1360	37	24,000
C_4	1380	35	20,000

Etched specimens, plated at 70° C (158° F), 5.0 asi

Designation	Chromium Thickness 0.00001 in.	Applied Stress 1000 psi	No. of 1000 cycles
D_1	350	40F	114
D_1	260	30F	271
D_1	270	25F	604
D_1	320	23F	498
D_1	280	22	25,000
D_1	270	21	20,000

Etched specimens, plated at 70° C (158° F), 8.6 asi

Designation	Chromium Thickness 0.00001 in.	Applied Stress 1000 psi	No. of 1000 cycles
D_2	125	50F	206
D_2	120	44F	325
D_2	120	38F	613
D_2	100	36F	248
D_2	100	34F	621
D_2	120	34	20,000
D_3	350	50F	121
D_3	310	44F	108
D_3	300	34F	611
D_3	370	33	27,000
D_3	350	31	21,000
D_3	370	31	20,000
D_4	920	40F	412
D_4	880	38F	950
D_4	800	36F	359
D_4	1000	36	24,000
D_4	880	35	20,000

Etched specimens, plated at 70° C (158° F) 13.0 asi

Designation	Chromium Thickness 0.00001 in.	Applied Stress 1000 psi	No. of 1000 cycles
D_5	430	65F	19
D_5	380	60F	139
D_5	340	54F	320
D_5	350	52F	293
D_5	380	50	19,500

Etched specimens, plated at 70° C (158° F), 8.6 asi, baked

Designation	Chromium Thickness 0.00001 in.	Applied Stress 1000 psi	No. of 1000 cycles
D_6	370	55F	141
D_6	330	50F	248
D_6	320	45F	429
D_6	320	42F	539
D_6	370	40	20,000
D_6	310	40	879

Unplated nitrided specimens (separate batch)

Designation	Chromium Thickness 0.00001 in.	Applied Stress 1000 psi	No. of 1000 cycles
E_0	None	102F	2,896
E_0	None	100F	1,388
E_0	None	98F	2,599
E_0	None	98	20,000
E_0	None	96F	2,378
E_0	None	94	20,000

Nitrided and etched specimens, plated at 70° C (158° F), 8.6 asi

Designation	Chromium Thickness 0.00001 in.	Applied Stress 1000 psi	No. of 1000 cycles
E_1	110	90F	71
E_1	110	80F	126
E_1	120	77F	137
E_1	120	75	20,000
E_1	130	74	20,000
E_2	430	80F	152
E_2	400	77F	81
E_2	370	76F	110
E_2	370	75F	129
E_2	400	75F	20,000
E_2	370	72	20,000
E_3	920	70F	84
E_3	910	65F	153
E_3	880	63	20,000
E_3	890	62	20,000
E_3	900	60	20,000

Unplated 60° V-notched specimens

Designation	Chromium Thickness 0.00001 in.	Applied Stress 1000 psi	No. of 1000 cycles
F_0	None	40F	93
F_0	None	32F	301
F_0	None	30F	740
F_0	None	29	25,500
F_0	None	28	23,300
F_0	None	28	20,000
F_0	None	13	40,000

TABLE IV continued

Designation	Chromium Thickness 0.00001 in.	Applied Stress 1000 psi	No. of 1000 cycles
Unplated nitrided 60° V-notched specimens			
G_0	None	70F	32
G_0	None	55F	339
G_0	None	48	588
G_0	None	45F	1,238
G_0	None	43	20,200
G_0	None	43	24,600

tested "as plated" or after baking at 205° C (400° F) for 16 hours, or had been nitrided before plating. With a plating temperature of 70° C (158° F), such a gradual decrease was found only for the nitrided specimens but not for the specimens with plate on untreated steel. The latter showed a sharp initial drop in fatigue limit with less than 0.0012 inch plate, but further increases in thickness had no clear-cut effect.

Nitriding of the steel raised its fatigue limit substantially (compare C_0 and E_0 with A'_0), but on subsequent chromium plating, the nitrided steel was found to be more affected by increasing plate thickness than the straight steel. Thus with more than 0.007 inch chromium deposited at 55° C (131° F) and, by very approximate extrapolation, with more than 0.024 inch chromium applied at 70° C (158° F), the untreated steel had higher fatigue limits than the nitrided steel.

Baking after plating at 205° C (400° F) for 16 hours caused a substantial decrease in the fatigue resistance of the untreated steel plated at 55° C (131° F) (compare the B-curve with the A-curve in Fig. 3), but had the opposite effect in the case of the 70° C (158° F) coating (compare D_5 with D_3 in Fig. 4).

For the same 55° C coating, Fig. 6 shows a pronounced drop in hardness and rise in number of cracks per field. Fig. 7 for the same 70° C coating, however, shows no drop in hardness, although there is a rise in the number of cracks.

TABLE V

Effect of Baking Time on Fatigue Strength of Chromium Plated SAE 4340 Steel

Chromium Plated at 55° C (131° F), 2.1 asi.
Baked at 205° C (401° F).
F indicates ailure.

Baking Time, hr	Applied Stress 1000 psi	No. of 1000 cycles
None	55F	136
1	55F	98
2	55F	94
4	55F	88
8	55F	113
16	55F	103
None	53	20,000
1	53F	101
2	53F	106
4	53F	145
8	53F	83
16	53F	106

Table V shows that 55° C, median current density chromium coatings after baking at 205° C for one hour exhibit no further substantial change in fatigue resistance up to 16 hours baking time. For the same coating, Fig. 6 shows substantial change in the plate hardness with heating time, but the number of cracks took a sharp rise at between 6 and 16 hours.

In Fig. 5 the two B-curves for baked 55° C coatings of two different thicknesses and the D-curve for unbaked 70° C coatings show an increase in fatigue limit with increasing plating current density. Within the experimental range, a comparison between the A-curve in Fig. 3 and the D-curve in Fig. 4, both for unbaked coatings on non-nitrided steel, show median current density chromium deposits to cause much less of a decrease in fatigue resistance when applied at 55° C than when plated at 70° C.

An examination of the hardness and crack curves for the same deposits in Figs. 6 and 7 gives the following results: The hardness values of the 55° C coatings unbaked (and baked at 205° C for 16 hours) are 750 (725) at 0.71 asi, 900 (750) at 2.1 asi and 925 (725) at 2.95 asi, and the number of cracks per field is 6 at 0.71 asi (note low thickness), 15 at 2.1 asi and 7 at 2.95 asi. The hardness

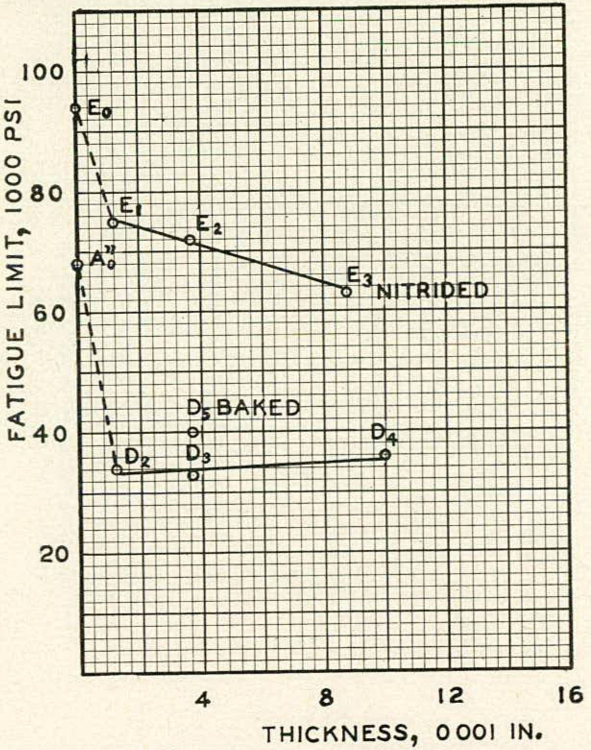

Fig. 4. Effect of plate thickness, nitriding before plating, and baking after plating on the fatigue strength of superfinished SAE 4340 steel, bright chromium plated a 70° C (158° F and median current density of 8.6 asit)

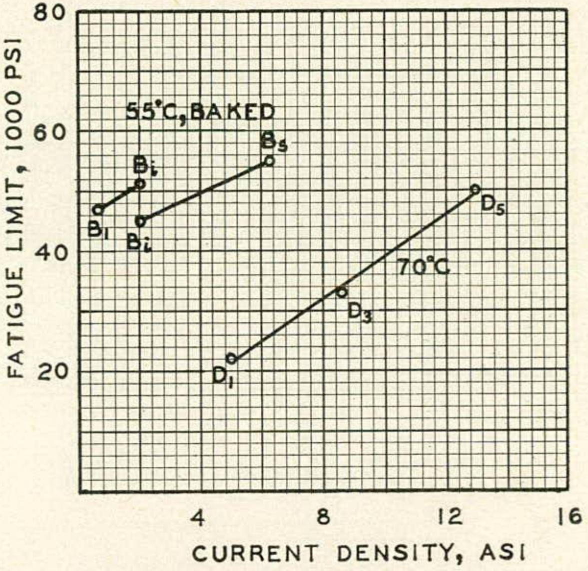

Fig. 5. Effect of current density during chromium plating at 55° and 70° C (131° and 158° F) on chromium plated superfinished SAE 4340 steel. Specimens from low emperature bath baked after plating Points B_i are interpolated from curve B in Fig. 3. Plate thicknesses for curves from left to right: 0.0020, 0.0033 and 0.0028-0.0038 inch

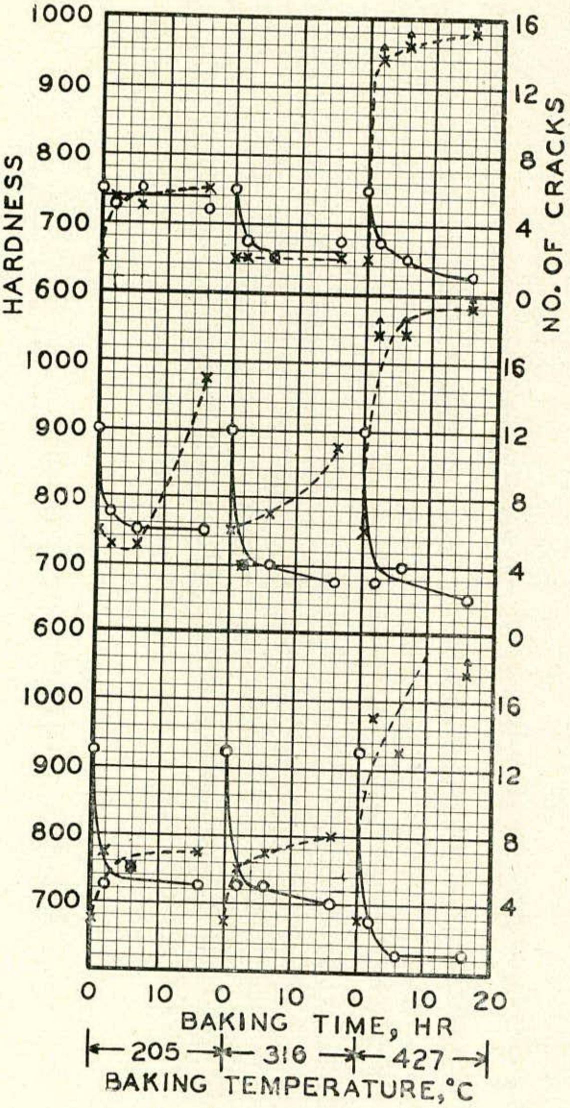

Fig. 6. Eberbach micro-hardness of and number of cracks per field in chromium coatings deposited at 55° C (131° F). From top to bottom: 0.0021-0.0026 inch coatings at 0.71 asi (low limit of bright range), 0.0036-0.0045 inch coatings at 2.1 asi (linear median of bright range), and 0.0032-0.0040 inch coatings at 2.95 asi (upper limit of bright range)

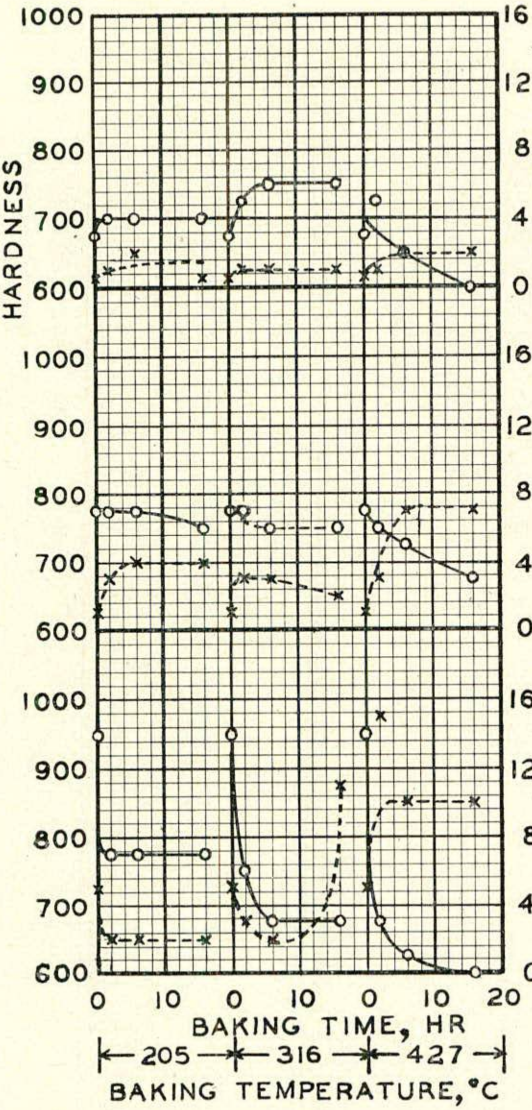

Fig. 7. Eberbach micro-hardness of and number of cracks per field in chromium deposited at 70° C (158° F). From top to bottom: 0.0015-0.0020 inch coatings at 5.0 asi (low limit of bright range), 0.0022-0.0032 inch coatings at 8.6 asi (linear median of bright range), and 0.0024-0.0034 inch coatings at 13.0 asi (upper limit of bright range)

TABLE VI

Effect of Plating Bath Temperature and Current Density as well as Baking Conditions after Plating on Crack Formation, Porosity and Hardness of Chromium Plate on SAE 1020 Steel

Eberbach Micro-Hardness Diamond Tester, 100 g load. Field observed with magnification 100X

Plating Bath		Baking		Hardness	Cracks per Field			Notes
Temp °C	Current Density asi	Temp °C	Time		Small	Medium	Large	
55	0.71	None	None	750	....	1–3	....	
55	0.71	205	2	725	5	1 (occ.)	....	Cracks unoriented
55	0.71	205	6	750	4	1	....	Porous
55	0.71	205	16	725	5	....	1	Porous
55	0.71	316	2	675	....	2 (edge)	....	More porous
55	0.71	316	6	650	1	....	1	Porous
55	0.71	316	16	675	1 (ctr)	1 (edge)	....	Porous
55	0.71	427	2	675	20–30	....	1 (edge)	Porous areas
55	0.71	427	6	650	30–40	....	Sev. (edge)	Porous
55	0.71	427	16	625	Many	....	Many	Very porous
55	2.1	None	None	900	6	....	....	
55	2.1	205	2	775	4	1	....	
55	2.1	205	6	750	4	....	1	
55	2.1	205	16	750	15	....	....	
55	2.1	316	2	700	....	4 (ctr)	....	Some cracks dendritic, sl. porous
55	2.1	316	6	700	6	....	1	Large crack branching, porous, checked edges
55	2.1	316	16	675	10	....	1	Porous
55	2.1	427	2	675	20–30	....	1	Large crack checked
55	2.1	427	6	700	....	20–30	....	Many cracks Y-shaped
55	2.1	427	16	650	Many	....	Many	Cracks checked
55	2.95	None	None	925	Sev.	....	....	Edge cracks checked
55	2.95	205	2	725	7	....	....	
55	2.95	205	6	750	6	....	....	Tendency to check
55	2.95	205	16	725	7	....	....	
55	2.95	316	2	725	....	6	....	
55	2.95	316	6	725	6	....	1	
55	2.95	316	16	700	7	1	....	
55	2.95	427	2	675	....	15	....	
55	2.95	427	6	625	10	3	....	
55	2.95	427	16	625	20–30	....	....	
70	5.0	None	None	675	....	1 (occ.)	....	
70	5.0	205	2	700	....	....	1	
70	5.0	205	6	700	1	....	1	
70	5.0	205	16	700	....	....	1 (occ.)	

TABLE VI continued

Plating Bath		Baking		Hard-ness	Cracks per Field			Notes
Temp °C	Current Density asi	Temp °C	Time hr		Small	Medium	Large	
70	5.0	316	2	725	....	....	1	
70	5.0	316	6	750	....	....	1–3	
70	5.0	316	16	750	....	....	1–3	
70	5.0	427	2	725	....	....	1	
70	5.0	427	6	650	....	....	1-3	
70	5.0	427	16	600	....	....	1-3	
70	8.6	None	None	775	....	1	....	
70	8.6	205	2	775	....	3	....	Some cracks checked
70	8.6	205	6	775	....	....	4	Some cracks checked
70	8.6	205	16	750	....	4	....	
70	8.6	316	2	775	....	3	....	
70	8.6	316	6	750	....	3	....	
70	8.6	316	16	750	....	....	2	
70	8.6	427	2	750	....	....	3	
70	8.6	427	6	725	5	....	2	
70	8.6	427	16	675	....	6–7	....	
70	13.0	None	None	950	....	5	....	
70	13.0	205	2	775	....	2	....	
70	13.0	205	6	775	....	2	....	
70	13.0	205	16	775	....	2	....	
70	13.0	316	2	750	....	3	....	
70	13.0	316	6	675	....	2	....	
70	13.0	316	16	675	10	....	1	
70	13.0	427	2	675	15	....	....	
70	13.0	427	6	625	10	....	....	
70	13.0	427	16	600	5	5	....	

of the unbaked 70° C coatings is 675 at 5.0 asi, 775 at 8.6 asi and 950 at 13 asi, and the crack numbers 1 at 5.0 asi, 1 at 8.6 asi and 5 at 13.0 asi.

One must conclude from the foregoing that a strict parallelism between fatigue resistance on the one hand and plate hardness and number of cracks on the other hand does not exist. There is a tendency for the hardness and the number of cracks to drop with dropping fatigue resistance, but this trend does not always hold and may even reverse itself in individual instances.

As a matter of fact, the parallel between hardness and number of cracks observed in the isolated cases set forth is not found to be general when Figs. 6 and 7 are inspected, because with few exceptions the number of cracks is reduced when the hardness rises.

Reference

[1] Wiegard and Scheinost, "Fatigue Strength of Hard Chromium Plated Steel". *Z. Ver. deut. Ing.* **83**, 655–659 (1939).

LABORATORY APPARATUS

for controlled current distribution on small, flat specimens

by J. B. Mohler, *formerly Supervisor of Physical Chemical Laboratory, and* R. A. Schaefer, *Director of Research . . . The Cleveland Graphite Bronze Company, Cleveland, Ohio*

INTRODUCTION

The usual laboratory procedure for the investigation of plating baths consists in plating a panel suspended between two anodes; in this arrangement the current density varies quite widely over the area. In the preparation of panels for corrosion testing, the panels are selected or prepared to minimize this variation either by plating a relatively large assembly composed of a number of panels fastened edge to edge and using the middle portion for evaluation or by plating a large sheet and cutting the evaluation panels from the central portion. However, for preliminary experimental work in electrodeposition of alloys, it is very desirable to use a standard Pyrex beaker for the vessel with individual flat steel cathode approximately 4 x 6 x 1/16 inch.

Since it is essential to maintain a uniform current density over the entire area of the panel[1], an apparatus was developed by employing the principle of insulating boundaries. For theoretical considerations the cathode may be considered an infinite number of parallel circuits with the current distributing itself according to the inverse square of the distance between the electrodes. Insulating walls placed between the anode and the cathode can be conveniently substituted for apparent distance which equalizes the current density on all points of the cathode or can be used to obtain a uniformly varying current density. This case has been theoretically developed by Kasper[2] in the line-plane system of insulating boundaries extending indefinitely at right angles to the cathode with the anode being a line-electrode parallel to the plane walls. The well-known Haring cell[3] is an application of this principle employing the walls of a closed plating vessel to obtain uniform current density.

Another common cell which uses the insulated walls of the vessel as shadows is the Hull cell[4]. This cell is used to study the plating range where it is desirable to obtain a different current density at any line on the cathode parallel to the anode. It might be called a universal plating cell in that it will give valuable information on the plating bath at varying controlled current density. Occasionally, to overcome polarization of the anode in the Hull cell, it is desirable to take advantage of a large anode by suspending a modified Hull cell directly in the plating bath. The modifications which have been developed will be explained in another section of this article.

EXPERIMENTAL

Plating Cells for Uniform Current Density on Flat Specimen

A large number of exploratory cells were constructed to determine for a cathode of a given size the physical dimensions of the insulating walls required to obtain a uniform current distribution. Since current distribution represents metal distribution in the practical plating range, the thickness of

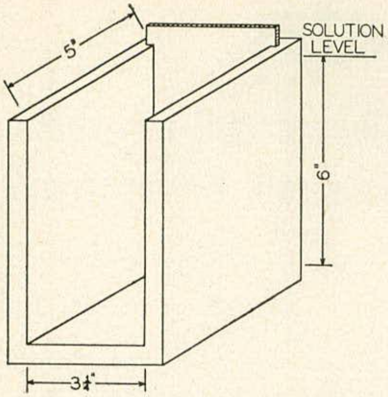

Fig. 1. Minimum insulating wall dimensions for uniform current density irrespective of anode position on a 4 x 4 x $\frac{1}{16}$ inch flat SAE 1010 steel

metal deposited on the cathode was used as a measure of the uniformity of the current density. The cathode was a smooth, polished, clean chromium plated surface from which the plate could be readily stripped, measured, weighed, or analyzed.

A typical cell is shown in Fig. 1. The experimental work clearly indicated that a cell can be constructed which will give a uniform current density for a definite anode and cathode relationship. However, the ideal cell should have no limitations on the relative position of the electrodes. If the sides are extended indefinitely, mathematically speaking, one reaches a point where the relative position of the electrodes has little or no influence on the thickness of the deposit. Generally speaking, if the depth of the insulating walls is less than the width of the cathode, the anode must be directly in front of and centrally located with respect to the cathode, whereas, if the depth of the insulating walls exceeds the width of the specimen, the anode position is relatively unimportant.

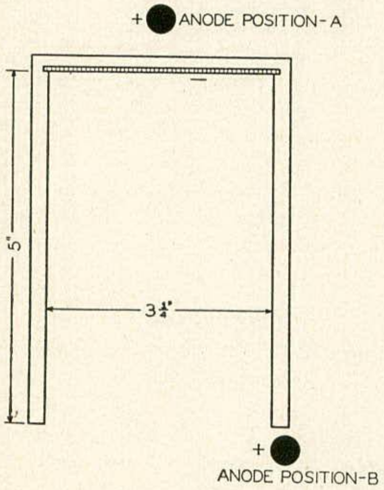

Fig. 2. Two extreme anode positions with respect to cathode for the cell in Fig. 1 (schematic)

TABLE I

Plate Distribution on Cathode with Anode Positions Shown in Fig. 2

Position on Specimen	Relative Thickness	
	Anode Position A	Anode Position B
1	1.00	.97
2	.98	.95
3	1.01	1.00
4	.99	.98
5	1.00	1.01
6	1.00	1.01
7	1.01	1.01
8	1.00	1.00
9	1.00	1.02
10	1.01	1.02
11	1.01	1.02
12	1.02	1.02
13	.98	.97
14	.98	.95
15	1.01	1.02

In Table I is listed the thickness data obtained with the anode in the unfavorable positions "A" and "B" illustrated in Fig. 2. The recorded thickness is a relative value with the thickness on the central section 8 arbitrarily assigned a value of 1.00. The probable accuracy of the method is ± 2 per cent for any individual section. In Fig. 3 are shown the exact positions of the specimens taken for thickness determinations with the numbers corresponding to those in Table I. The deposit consisted of lead[5] plated from a lead fluoborate bath for 40 minutes at an average current density of 20 asf.

Table I shows that if the length of the sides and bottom of the cell is at least 1½

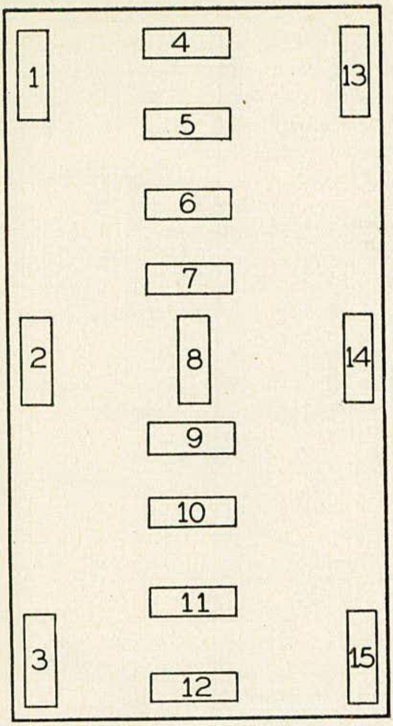

Fig. 3. Positions from which specimens were cut to determine data in Table I. The plated specimen was 6 x 4 x $\frac{1}{16}$ inch flat SAE 1010 steel, the insulating walls of the cell 6 x 3¼ x 5 inch deep

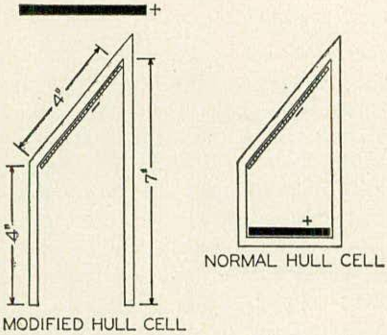

Fig. 4. Modified Hull cell with the insulated sides and bottom extended in comparison to the normal Hull cell

times the width of the cathode, the current is distributed uniformly within 3 per cent even if the anode is in a very unfavorable position.

Modified Hull Cell for Controlled Varying Current Density Studies

Experimental work has indicated that the Hull cell can be conveniently modified in either of two directions. The first modification is had by increasing the length of the insulating sides and bottom to a minimum of 1½ times the length of the cathode. This construction is schematically represented in Fig. 4.

The experimental work consisted in depositing lead[5] and silver[6] on the cathode of the modified Hull cell at an overall current density of 20 and 6 asf respectively for 40 minutes and 2 hours respectively. Strips were cut and weighed, and the local current densities were calculated and listed in Table II.

From the plotted data, the following formulae can be developed from the positions of the lines:

$$A_{Pb} = 2(12 - 19.5 \log L)$$

$$A_{Ag} = 0.6(10.3 - 11.9 \log L)$$

where A_{Pb} = current density in asf in lead deposition

A_{Ag} = current density in asf in silver deposition

L = distance from high current density in inches.

The second modification consists in an extension of the insulating walls in a direc-

TABLE II

Plate Distribution on Cathode of Modified Cell Shown in Fig. 4

Distance from High Current Density End Inch	Log Inch	Current Density asf	
		Lead	Silver
.3	−.52	45	9.8
.7	−.16	30	7.7
1.1	.04	24	6.2
1.5	.18	18	5.2
1.9	.28	14	4.1
2.3	.36	10	3.4
2.7	.43	6	2.8
3.1	.49	4	2.6
3.5	.54	3	2.4

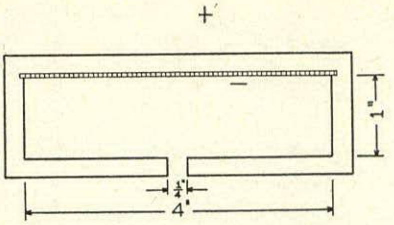

Fig. 5. Rectangular box type cell which produces uniform current density variation from either side of the center line

tion parallel to the cathode so that a box is obtained with one slot or a series of slots on the side of the rectangle opposite the cathode. In general, the single slot is most satisfactory, a typical cell being shown schematically in Fig. 5. The current density on the cathode varies regularly as the distance from the slot increases, regardless of the position of the slot. A cell with a centrally located slot, after calibration, may be conveniently used to determine the minimum current density at which plating can take place. For example, the $CrO_3:H_2SO_4$ ratio in a chromic acid bath could be determined from the width of the band of plate.

CONCLUSIONS

By reducing Kasper's theoretical data for the line-plane system of insulating planes to practice, convenient cells can be constructed which give either uniform or controlled varying current density.

The cells or racks may be constructed so that they are little affected by the size or the position of the anode. The independence of the anode is of value where the anode may cause polarization troubles or where it is desirable to have the anode an appreciable distance from the cathode. The cells have the advantage that they can be suspended directly in a plating bath.

Literature Cited

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[3] Haring, H. E. and Blum, W., *Ibid.* **44**, 313 (1923).

[4] Hull, R. O., *Proc. Am. Electroplaters' Soc.* **27**, 52 (1939); *U. S.* 2, 149, 344.

[5] Gray, A. G. and Blum, W., *Trans. Electrochem. Soc.* **80**, 645 (1941).

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1948 CONVENTION NEWS

The Thirty-fifth Annual Convention of the A. E. S. will be held on June 28, 29, 30 and July 1, 1948, in Atlantic City, N. J., with the Newark Branch as the host.

The several committees are now working earnestly and untiringly to make this the largest and best convention ever. Plans for the *Industrial Finishing Exposition* have been laid, and satisfactory progress is being made in getting the cooperation of both supply houses and platers.

The convention facilities of Atlantic City are superlative, undoubtedly the best in the world. Headquarters will be the Ambassador Hotel, one of the best of the City's many fine hotels. The Industrial Finishing Exposition will be held in Atlantic City Auditorium, the largest and finest exposition hall in America. Atlantic City is easily accessible by train, bus, and plane from every part of the continent.

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William F. Bruhns,
Publicity Chairman,
Convention Committee.

ELECTROLYTIC POLISHING OF CARBON-MANGANESE STEEL

A Critical Review of W. A. Spark's Article in J. Electrodepositors' Technical Society, 21, 245 (1946)

CHARLES L. FAUST
Battelle Memorial Institute, Columbus, Ohio

The author introduces his paper with a general discussion of the advantages and limitations of electropolishing. Particular reference is made to aluminum and stainless steel. The statement is made that a considerable amount of hand-polishing is required before electropolishing aluminum. For reflector quality, all hand-finishing or all electropolishing cannot match the quality of the combined hand-polishing and electropolishing. The opinion is expressed that electropolishing of stainless steel will supersede hand-finishing. Total reflectivity will be improved but specular reflectivity may not be so good.

Because of a lack of trained and skilled polishers accustomed to polishing carbon steels to close tolerances, electropolishing was investigated for finishing to close tolerances prior to chromium plating. Piston rods of hydraulic jacks and under-carriage shock absorbers required a high-class finish before chromium plating. The author investigated published compositions of electropolishing solutions and concluded that the sulfuric-phosphoric acid type was the most likely for large scale operations.* He studied different mixtures in the ranges of 90 per cent sulfuric to 10 per cent phosphoric and 10 per cent sulfuric to 90 per cent phosphoric acid. Percentages were by volume of acids, having the specific gravity of 1.80 and 1.75, respectively. Temperature was varied within the range of 20° C to 80° C (68° F to 176° F).

Specific reference is made to two baths: (1) 90 per cent phosphoric, 10 per cent sulfuric, 10 per cent water; and (2) 70 per cent phosphoric, 30 per cent sulfuric, 10 per cent water. (Parts by volume in both cases.) Tests were made at 1, 2, 4, and 6 asi and at 20, 40, 60, and 80° C. In bath (1) polishing was obtained only at 2, 4, and 6 asf at 60° and 80° C, and in bath (2), only at 4 and 6 asf at 60°, but at 1, 2, 4 and 6 asf at 80° F. In all tests, a standard area of steel tube was treated. Steel analysis showed: 0.27 per cent carbon and 1.53 per cent manganese. For the above conditions producing electropolishing, anodic efficiencies ranged from 41.7 per cent to 81.5 per cent. The minimum anode to cathode area ratio was found to be 1 to 2.5 and the maximum to be greater than 1 to 10. For electropolishing steel, the maximum permissible water content is placed in the region of 28 to 30 per cent and the minimum is about 9 per cent.

The effect of addition agents was investigated in sulfuric-phosphoric acid baths. It is postulated that effective addition agents must be capable of operating either to reduce the tendency for rapid dissolution of the anode or to strengthen the anode resistance layer. Dextrose, glycerine and chromic acid were studied.

Baths containing 45 to 50 per cent sulfuric acid and 55 to 50 per cent phosphoric acid (with water added to make 28 to 30 per cent by volume) and 3.5 per cent dextrose produced irregular polishes at 56° to 68° C and 6.5 to 11.0 volts. Current densty was 2 to 5 asf. When the sulfuric-phosphoric acid mixture was changed from 30 per cent to 70 per cent, by volume, it produced better electropolishing. Work rod movement was necessary in order to avoid

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*U. S. Patents 2,334,698 and 2,334,699.

severe grooving of the surface from gas discharge. Apparently the important function of the dextrose was to reduce the tendency to pit at higher current densities. Before electropolishing, the steel rods received the first grinding operation, and afterward they were rough- and finish-honed.

During use the dextrose carbonized and formed a black crust on the surface of the bath when it cooled. On reheating, the carbon was taken up and electropolishing conditions were again good. It is suggested that finely divided carbon black is the real addition agent when dextrose is used. Normal procedure was to hang the steel rods on the moving work bar at 7.8 to 8.5 volts without degreasing before electropolishing.

Pilot operation indicated that about 50 sq. ft. of surface could be electropolished per gallon of the bath containing dextrose. The electropolished surface offered more resistance to attack by industrial atmosphere than hand-polished surfaces.

When chromic acid addition was used in the sulfuric-phosphoric acid bath*, the electropolish finish was very high and mirror-like when conditions were carefully controlled. Reference is made to the falling-off of electropolishing ability with use of the bath†, as a result of the reduction of the chromate to chromic state of chromium.

The composition for the new solution is given as 47 per cent sulfuric acid, 43 per cent phosphoric acid, 5 per cent chromic acid being dissolved in the water before adding to the mixture. (Note: these are probably volume percentages and weight percentages intermixed; the basis is not clearly stated in the original article.) Operation at 47° C, 6.5 volts, and 1.8 to 3.5 asf produced a bright mirror finish.

Glycerine additions to the sulfuric-phosphoric acid type of bath did not lead to as high quality of finish as the dextrose and chromic acid additions. The latter also permitted a greater reduction in the required current density. For the current density ranges required for polishing, the voltage was 10 to 12 volts.

From the study of addition agents, it is suggested that they modify the anolyte layer so that the minimum point of anode efficiency is maintained over a wider range of operating conditions. Effective throwing power is increased, and polishing is assisted in irregular sections where gas flow would otherwise have caused film removal and etching. Other additions were tried by the author with the ultimate objective of strengthening the anolyte layer and generally improving the performance of the sulfuric-phosphoric acid baths. Fixanol, Oleyol, Triethanolamine, Perminal W. A., Perminal Col., Gemex (a), Gemex (Z7), Teepol, and beta-naphthol were investigated at 0.05 per cent concentration (by weight) in a bath consisting of 60 per cent phosphoric acid, 30 per cent sulfuric acid, 10 per cent water (by volume).

From the author's discussion, it appears that only Teepol X showed promise for assisting in the production of a high degree of surface finish. Two "samples", A and B, showed positive results, whereas sample C did not under the conditions that were tested. For A and B, the conditions were respectively: 70° C, 7.2 volts and 65° C, 7.7 volts. Both were 10-minute treatments.

The very important matter of the "cleanliness" of the steel is discussed. There is a need for a specification for cleanness and reference is made to "Test for Cleanness in Steel" in the book by F. T. Hill, *Materials of Aircraft Construction*, 4th Ed., 1940, Pitman, London.

Author Sparks states, "Alloying constituents do not appear to offer much cause for concern, except in the case of high carbon steels which often contain considerable quantities of tungsten. Steels have been satisfactorily polished in the phosphoric-sulfuric solutions containing the following alloying constituents:

Nickel	up to a max. of 3.75%
Molybdenum	up to a max. of 0.5 %
Chromium	up to a max. of 1.4 %
Manganese	up to a max. of 1.75%
Vanadium	up to a max. of 0.3 %"

Very high alloy steels were not encountered in the work being discussed, which

(*Continued on page 1399*)

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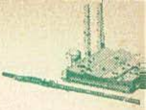
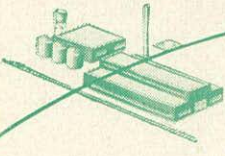
*U. S. Patent 2,338,321.

†C. L. Faust, Mo. Rev. Am. Electroplaters' Soc. **31**, 807 (1944).



OUR PLANTS BLOOM THE YEAR 'ROUND



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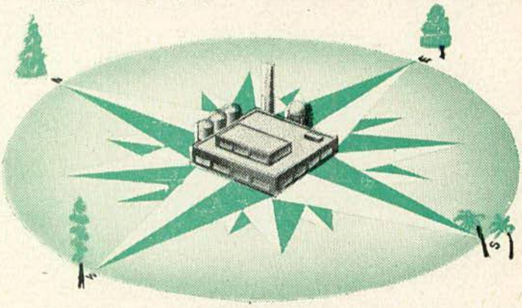

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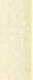

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THE RESEARCH ORGANIZATION OF THE AMERICAN ELECTROPLATERS' SOCIETY

RICHARD M. WICK

Bethlehem Steel Corporation, Bethlehem, Pa.

Dr. Wick, who is the Chairman of the Research Committee of the American Electroplaters' Society, prepared this paper at the request of the Executive Board of the Society, for presentation at the recent International Electrodeposition Conference held in London, England, under the sponsorship of The Electrodepositors' Technical Society.

The rate of future development of the field of electrodeposition depends on the continuous growth of pertinent fundamental and technical knowledge. The American Electroplaters' Society has recognized the necessity for sustained research effort to safeguard the future of electrodeposition. The scope of industrial and institutional research is governed in many instances by local circumstances, and in consequence seldom achieves either breadth or depth. As a rule, such research is directed to the solution of a specific problem and results in a commercial process of economic value. These factors pertain to the question of the definition of the scope and aims of a Research Program to be sponsored by a Technical Society.

The research activities of the American Electroplaters' Society were interrupted during the war period and were resumed late in 1944. In renewing the Society's Research Program after this lapse, careful attention was paid to the nature of future research work, the placement of research projects, and the organization for research that would be most effective. An adequate program for guaranteeing financial support is a fundamental requirement for a sustained research effort.

The Research Committee

The American Electroplaters' Society, through its Executive Board, placed the responsibility for the organization and administration of the Society's Research Program in the hands of a Research Committee composed of nine appointed members, with the President of the Society and its Executive Secretary as members ex-officio. Each appointee serves for a term of three years, three new members being appointed annually. The committee members elect the Chairman of the Research Committee. Quarterly meetings of the Research Committee are held, at which questions of policy are developed. The Committee approves each new research project prior to its installation in the program. There are four principal sub-committees charged with the administration of the Research Program under the authority of the Research Committee. These sub-committees are for Policy, Publicity, Finance, and Research Direction.

Sub-Committee on Policy. The Chairman of the Research Committee with the Chairmen of the Committees on Publicity, Finance, and Research Direction, comprise the Policy Committee. This committee administratively interprets the policy of the Research Committee in regard to the problems at hand and recommends for the approval of the Research Committee any necessary policy changes.

Sub-Committee on Publicity. The dissemination of information concerning the Society's Research Program, other than the technical publications, is the responsibility of the Publicity Committee. Due to the size of the research activity, it became manifestly necessary that all matters of publicity be cleared through a central committee in order that a consistent policy might be maintained. The Publicity Committee receives material pertaining to the research projects in progress from the Chairman of the Research Directing Committee. This specific information on the research projects is correlated with other pertinent matter for presentation in a suitably comprehensive and organized form.

The Finance Sub-Committee. Working closely with the active Branches of the American Electroplaters' Society, the Sub-Committee on Finance is engaged continuously in maintaining and increasing the list of Sustaining Members that comprise the industrial support for the Research Program. Through their Branches, many of the individual members of the Society contribute directly to the Research Fund. Sustaining Membership is awarded to industrial concerns and others contributing more than a minimum amount annually toward the Research Program. The current number of Sustaining Members approaches 300 and is growing rapidly. It is this financial support of industry that makes the extensive program possible.

The Research Directing Sub-Committee. The administration of the Research Program is the responsibility of the Research Directing Sub-Committee. The Research Committee operates exclusively through its Research Directing Committee in regard to the individual projects. The responsibility of this committee for administration is complete. It starts with the installation of the project at the university or other research center selected. The organization of the program, the appointment of the project sub-committee, the general guidance of the project throughout, and finally the determination of the correct time to terminate a given research in view of its original objectives, are part of the duties of this Sub-Committee.

The Research Program

The resumption of research prior to the end of the war afforded the opportunity to initiate a modern program, both comprehensive and basic, for investigations designed to increase the fundamental and technical knowledge necessary for substantial future advances in the science and technology of electrodeposition. Topics selected as subjects for research are component parts of a broad program. Definite interrelation exists between groups of research projects according to deliberate plan recognized in the co-administration of the active program. As an example, the projects on the analysis of impurities, the effect of impurities and purification are coordinate, and both complement the projects on porosity and on physical properties of electrodeposits.

It is held by the Research Committee that its researches should not duplicate work in progress by others. It is a matter of policy that the researches should tend to expand knowledge on technical and fundamental matters rather than duplicate the objectives of industrial research laboratories in regard to the development of operating processes. The Research Program is designed for long range operation, and the firm policy to avoid researches on commercial processes is an important keystone in the permanent structure of the work. It is to be expected that increased progress in the development of commercial processes by the industry in general will be one result of the successful execution of our basic program.

In furtherance of the broad objective of these researches, every assistance and encouragement possible is rendered others interested in researches in the field of electrodeposition. The preexistence of research activity in a given university is not a prerequisite for active participation in this program. It is considered beneficial to the field of electrodeposition to stimulate the interest of professors competent in research, so that in some instances the Society's research project becomes the first project within the university in the field of electrodeposition.

Active Research Organization

After correct selection of research projects and adequate financing, the continuing success of the Research Program is determined by the calibre of organization, correlation, and supervision afforded by the Research Directing Committee. The Chairman of the Research Directing Committee is the central authority for administration. He is assisted by Vice-Chairmen each supervising a group of projects. Reporting through the Vice-Chairmen are Project Committees, each comprising three men selected from industry, who can confer with and advise the Project Director on all technical matters pertaining to his research. The Project Director is generally a professor of our own selection who is directly responsible for the research results. He is assisted by a graduate student, usually through a fellowship established at the university. Alternatively, the project may be at a research institution such as the National Bureau of Standards or an industrial research laboratory, depending upon the location of the Project Director.

It was an original conception of this program to combine the academic viewpoint of the university, through the professor selected, with the industrial viewpoint, by the appointment of the most competent men avilable from industry to form the three-man Project Committee. Experience during three years has more than justified this policy. The total force applied to each research comprises at least seven men: the Research Fellow, the Project Director, the three industrial specialists comprising the Project Committee, and the Vice-Chairman and the Chairman of the Research Directing Committee. Fine relationships have developed between the Project Directors and the industrial specialists, all focusing their attention on the same projects. Unsolicited testimony from both groups shows that the combination of talent is both beneficial and welcome.

In most research projects the initial step is the development of a bibliography followed by a correlated abstract and critical review of the published literature. In only a few cases has this appeared undesirable, and in those cases the determination has been to publish the state-of-the-art material at the end rather than at the beginning of the project. The permanent value of such critical literature reviews was never doubted, but the evident value of such work has become enhanced, for example, through the uncovering of more than 2,400 references on the subject of "Impurities and Purification of Electroplating Solutions". It is the purpose of this part of the work to secure as complete literature coverage as possible in order to facilitate all future researches along similar lines.

The specific experimental program is developed during the initial period devoted to the literature study. The most recent organizational modification is the institution of a temporary "Project Organizing Committee", the purpose of which is the development of the specific program prior to the active installation of the project.

Publication of the results of the Research Program is made usually in THE MONTHLY REVIEW* of the American Electroplaters' Society. Annually a report is made to the Society, at its Convention, on elements of each project. These reports appear in the *Proceedings* of the American Electroplaters' Society. Individual papers, or short series of papers, on a given project are bound in booklet form as Research Reports and made available at slight cost. A library of these Research Reports will one day constitute an important source of technical information in our field. This system of Research Reports is not unlike that employed by the International Tin Research and Development Council.

List of Researches

The first three of the list of active researches reflect the war conditions prevailing at the time the present research activity of the American Electroplaters' Society began. The projects on "Stripping of Copper", "Determination of Impurities", and "Adhesion" are recognizable as subjects that were of particular interest then. In the accompanying list there is given the serial number and the title of each research, the Project Director's name and affiliation, and the

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*Beginning January, 1948 THE MONTHLY REVIEW will be called PLATING.

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Project No.	Title	Location	Project Director and Assistant	Project Directing Sub-Committee	Year Project Accepted
1.	*"Stripping of Copper from Various Base Metals"*	Indiana University	Prof. F. C. Mathers Mr. E. L. Martin (Assistant)	Mr. L. E. Weeg, Chairman, C. G. Conn, Ltd. Mr. L. C. Borchert, Houdaille-Hershey Corp. Dr. H. J. Wiesner, C. G. Conn, Ltd.	1944
2.	*"Determination of Impurities in Electroplating Solutions"*	Lehigh University	Prof. E. J. Serfass Mr. W. S. Levine (Assistant) Mr. P. J. Prang, Jr. (Assistant)	Dr. D. G. Foulke, Chairman; Hanson-Van Winkle-Munning Co. Dr. W. R. Meyer, The Enthone Co. Dr. Henry B. Linford, Columbia University	1944
3.	*"Methods for Testing Adhesion"*	University of Michigan	Prof. A. L. Ferguson Mr. M. R. Makepeace (Assistant) Mr. M. U. Tsao (Assistant)	Dr. R. B. Saltonstall, Chairman; Udylite Corp. Mr. F. C. Mesle, Oneida, Ltd. Mr. E. Hahn, Ainsworth Manufacturing Co.	1944
4.	*"Effect of Surface Finishing of Non-Ferrous Base Metals on Protective Value of Plated Coatings"*	U. S. Time Corp., Middlebury, Conn.	Dr. George J. Kahan Mr. John W. Rigney (Assistant) Mr. J. O. Fairbanks (Assistant) Mr. Joyce Mulcrone, (Assistant)	Mr. M. B. Diggin, Chairman; Hanson-Van Winkle-Munning Co. Mr. E. A. Anderson, New Jerzey Zinc Co. Mr. A. W. Tracy, The American Brass Co.	1947

Project No. Title	Location	Project Director and Assistant	Project Directing Sub-Committee	Year Project Accepted
5. "*Effects of Impurities and Purification of Electroplating Solutions*"	Michigan State College	Prof. D. T. Ewing Mr. W. D. Gordon (Assistant)	Mr. B. C. Case, Chair man; Hanson-Van Winkle-Munning Co. Mr. L. B. Sperry, Doehler-Jarvis Co. Mr. R. C. Olsen, General Motors Corp.	1945
6. "*The Nature and Effect of Porosity in Electrodeposits*"	Princeton University	Dr. N. Thon Mr. E. T. Addison (Assistant)	Dr. W. A. Wesley, Chairman; International Nickel Co. Dr. B. Egeberg, International Silver Co. Mr. A. Mendizza, Bell Telephone Lab., Inc.	1946
7. "*Methods for Testing Thickness of Electrodeposits*"	Pennsylvania State College	Prof. H. J. Read Mr. J. H. Thompson (Assistant)	Mr. J. Mazia, Chairman; American Chemical Paint Co. Mr. G. Bowman, Standard Steel Spring Co. Mr. A. H. DuRose, Harshaw Chemical Co.	1946
8. "*Polarization at Electrodes in Electroplating Processes*"	University of Michigan	Prof. A. L. Ferguson Mr. R. S. Karpiuk (Assistant)	Dr. R. A. Schaefer, Chairman; Cleveland Graphite Bronze Co. Mr. E. Hahn, Ainsworth Manufacturing Co. Mr. G. Dubpernell, United Chromium, Inc.	1946
9. "*Physical Properties of Electrodeposited Metals*"	National Bureau of Standards	Dr. A. Brenner Mr. C. W. Jennings (Research Associate)	Dr. W. Blum, Chairman; National Bureau of Standards Mr. C. H. Sample, International Nickel Co. Mr. N. Promisel, Bureau of Aeronautics, Navy Department	1947
10. "*The Disposal of Plating Room Wastes*"	Yale University	Prof. B. F. Dodge Mr. D. C. Reams (Assistant)	Dr. C. F. Gurnham, Chairman; Whitney-Blake Co. Mr. M. L. Ross, E. I. du Pont de Nemours & Co. Mr. M. A. Orr, International Silver Co.	1947
11. *Current and Metal Distribution in Electroplating*"	Negotiating	....	....	......
12. "*Cleaning and Preparation of Metals for Plating*"	Negotiating	....	....	......
13. "*Internal Stress in Electrodeposits*"	Negotiating	....	....	......

date on which the project was accepted by the Research Committee as part of the program. This information is shown in the Table

The first project was instituted under the direction of Professor F. C. Mathers at Indiana University on "Stripping of Copper from Various Base Metals". This project, begun in 1944, is not now active. It had as its objective immediate practical results that were obtained and found to be useful.

"The Determination of Impurities in Electroplating Solutions" is the second project. It was placed originally under the direction of Professor G. Frederick Smith at the University of Illinois, with Professor Frederick Duke as the Research Fellow. Less than a year later, in 1945, the project was assigned to Professor E. J. Serfass at Lehigh University, where it is active today. Numerous individual papers on specific methods of analysis of impurities in nickel plating solutions have been published from this project These methods are available in bound form as Research Reports. The work is continuing on the study of impurities in copper plating solutions and will cover ultimately all commercial plating solutions.

The third project of the original group began in 1944 and was entitled: "Methods for Testing Adhesion". Professor A. L. Ferguson at the University of Michigan was appointed Project Director. The survey of the literature on "Adhesion of Electrodeposited Metals" is particularly complete. In addition, valuable information was brought to light through the publication of two papers covering the private file data that had been furnished to Professor Ferguson during the course of his investigation.

Project No. 4 is a continuation of previous work on ferrous metals by Dr. William Blum at the National Bureau of Standards. This project is entitled: "The Effect of Surface Finishing of Non-Ferrous Base Metals on the Protective Value of Plated Coatings". It has been placed at the Research Laboratory of the U. S. Time Corporation at Middlebury, Conn.; the Project Director is Dr. George J. Kahan. Among the least known of the several factors influencing the protective value of plated coatings is the quantitative effect of surface finishing, especially of non-ferrous metals. It is the objective of this project to determine whether surface finishing, particularly within commercial limits, can effect a significant influence on the protective value afforded by the plated coating.

The project on "Effects of Impurities and Purification of Electroplated Solutions" is the fifth project in the research program. It was begun in 1945 under the direction of Professor D. T. Ewing at the Michigan State College. Close cooperation exists between Project No. 2 on the analysis for impurities, and this project. The literature on this subject can be found to be so extensive as to render it substantially unavailable. The correlation of this literature, which is being done stepwise in reference to individual plating solutions as a matter of convenience, represents a valuable contribution. Experimental work now in progress is bringing to light new data of permanent value.

In 1946, a fundamental research on "The Nature and Effect of Porosity in Electrodeposits" was instituted at Princeton University. Dr. N. Thon is the Project Director, working in the laboratory of Professor Hugh S. Taylor, with whom he is associated. The critical literature review just published by Dr. Thon as part of this program is an outstanding contribution to this subject in which so little real progress has been made. Results of fundamental importance are a reasonable expectation from the continuance of this Research Project.

A matter of prime importance to all electrodepositors is the determination of the thickness of coatings. Accordingly, the seventh research project, entitled "Methods for Testing Thickness of Electrodeposits", was instituted in 1946 at the Pennsylvania State College. Professor Harold J. Read is the Project Director. The critical review of the plenteous literature is nearly completed. It is the objective of this research to develop comparative data on the precision and accuracy of the applicable methods for determining thickness of all commercial electrodeposits on the several base metals to which they are normally applied.

Professor A. L. Ferguson at the University of Michigan has undertaken his second project for us as Project Director of our eighth research on "Polarization at Electrodes in Electroplating Processes". Circumstances beyond our control will require a temporary deferment of this project, but not before preparation of the literature survey and review can be completed.

Dr. William Blum at the National Bureau of Standards is a member of the Research Committee. Through his arrangement we are fortunate in having his associate Dr. Abner Brenner with us as Project Director for Project No. 9 on "Physical Properties of Electrodeposited Metals". This project is uniquely located at the National Bureau of Standards in Washington, D. C., where there are unsurpassed facilities for the specialized scientific techniques required in research of this character. This project, which began in 1947, is now well under way and is developing basic technical data that are much needed.

A chemical engineering problem that is increasingly important is the subject of our tenth project on "The Disposal of Plating Room Wastes". Professor B. F. Dodge, head of the Department of Chemical Engineering at Yale University, is Project Director. The problem of plating room waste disposal is not simple, including as it does chromic acids and cyanides as well as mineral acids and alkalies. A further complication is that methods eminently suitable for large installations are unsuitable for the small shop. Accordingly, it is an objective of this research to develop methods for small scale operations as well as for the larger users of electrodeposition.

Three remaining projects complete the current list at this writing: "Current and Metal Distribution in Electroplating", "Cleaning and Preparation of Metals for Plating", and "Internal Stress in Electrodeposits". Those three projects represent the immediate extension of the Research Program and are to be installed upon completion of their technical organization and the selection of the Project Director and university center.

Recognizing that the research organization described above and outlined in Table I is actively in progress, it is evident that a new opportunity has been afforded interested industry to cooperate both technically and financially in support of the program. This support has been realized in very practical terms. Not only has industry given generous financial support, but it has welcomed the opportunity for its technical staffs to participate actively in the program through work on the committees. The broad benefits of participation in this program are becoming still more apparent as the researches gather momentum.

Close interrelation and cooperation is maintained with coordinate societies. The American Society for Testing Materials is closely connected with our research work through the joint membership of several individuals on both groups. In extension of previous close relations, the A. S. T. M. is the issuing source for specifications that may develop from the American Electroplaters' Society Research Program. Similarly, the Electrochemical Society, the American Zinc Institute, the American Iron and Steel Institute, etc., have cooperated in one or another degree in connection with the program or its elements. The coordinate relation between the Research Program and the activities of other Societies is increasing steadily.

The purely technical and scientific basis of the Research Program has served to eliminate personal considerations to a marked degree, and has resulted in an exceptionally altruistic attitude on the part of each individual associated in this work. This desirable situation is made possible partly by the careful avoidance of conflict with industrial research interests. The criterion for all decisions in regard to the administration of these researches has been the best good for the field of electrodeposition. The satisfaction of accomplishment and interest in the work is the only compensation afforded the committee members.

The development and organization of the Society's present Research Program has been organic. Although it developed rapidly, it did not spring forth fully grown. Many problems were encountered in establishing the researches which, aside from the program subjects, included the selection of Project Directors, contractual relations with universities, selection of Project Committee

A. E. S. RESEARCH PROJECT No. 2 TO STUDY COPPER BATHS

The *Project Directing Committee* for *A.E.S. Research Project No. 2* has announced completion of the first phase of its work: the development of analytical methods for the trace impurities of lead, iron, manganese, copper, cadmium, chromium, silica, zinc, calcium, aluminum, sodium, potassium, and ammonia in nickel plating baths. Two general papers on the analytical procedures have been published[1,2], and specific procedures for the first four metals listed have also appeared[3,4,5,6] in THE MONTHLY REVIEW and in reprint form. The remaining papers are in the hands of the Committee for final review, and will be published in the near future.

The next work of this Project will be a similar study of copper plating baths, including both acid and cyanide types. The impurities tentatively selected for investigation are: chromic acid, lead, nickel, silver, tin, zinc, and chloride. In this connection, the advice of the members of the A. E. S. is earnestly requested: Are there other impurities for which analytical methods should be developed, or are some of those listed of no importance so that they should be dropped? This Project is, of course, handled in close cooperation with the committee on Project No. 5 on Effects of Impurities and Purification of Electroplating Solutions, but in addition correspondence would be appreciated from other members and friends with experience in this work. Following the investigations on copper, it is planned to study zinc, cadmium, and silver plating solutions.

The membership of the Project No. 2 Committee includes *Dr. D. Gardner Foulke*, Hanson-Van Winkle-Munning Company, Matawan, N. J., Chairman; *Dr. Walter Meyer*, Enthone, Inc., New Haven, Conn., and *Dr. Henry B. Linford*, Columbia University, New York. Please send suggestions on this work to any of these Committee members. The Project is being carried out at Lehigh University under the direction of *Professor Earl J. Serfass* of the Department of Chemistry.

C. FRED GURNHAM, *Vice-Chairman,*
Research Directing Committee.

References

[1] Foulke, D. G., Meyer, W. R., and Case, B. C. *Monthly Review* **33,** 836–842 (1946).

[2] Serfass, E. J. and Levine, W. S. *Ibid* **33,** 1073–1079 (1946).

[3] *Ibid.* **33,** 1079–1087 (1946).

[4] *Ibid.* **33,** 1189–1197 (1946).

[5] *Ibid.* **34,** 320–327 (1947).

[6] *Ibid.* **34,** 454–462 (1947).

References [1] to [6] have been reprinted in A. E. S. Research Report Serial No. 3, available from Society headquarters at 50 cents a copy.

Research Organization

(*Continued*)

personnel from the standpoint of capacity, interests and geographical location, and the initiation of the desired *modus operandi*. The interrelationship between projects, fostered by exchange of current information, and the development of private file data from industrial concerns and private sources, made possible by the Society's sponsorship, are all aspects of the program in motion. Continuation of this research for a period of ten years, augmented by the work of other interested groups, gives promise of a decade of fundamental progress heretofore unequaled.

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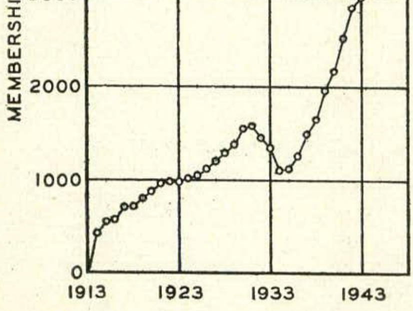
A. E. S. ACTIVE MEMBERSHIP PASSES 5000

It is with considerable pride that we announce that the Society's active membership has passed the 5,000 mark. Credit goes not only to A. E. S. Membership Chairman, Second Vice-President Arthur W. Logozzo, and all the membership committees of the Branches but also to their many predecessors who have so freely devoted their best efforts to the success of the Society.

Our thoughts go back to that small devoted group who launched the Society at a meeting in New York City in 1912 and to those who, in 1909, formed the predecessor society, the National Electro-Platers Association of the United States and Canada. Charles H. Proctor, George B. Hogaboom, J. H. Hansjosten, Arthur B. Wells, Horace H. Smith, Walter Fraine, William H. Barrows, and F. J. Liscomb are some of the names that stand out and always will be remembered.

These men and their fellows showed much foresight: They made the A. E. S. an educational society instead of a foreman's union which many desired. They also based the Society on local Branches, a move which assured a broad popular support. The wisdom of their actions is shown by the Society's growth illustrated in the accompanying graph. Except for the depression years 1922–1923 and 1932–1934, the expansion has been steady and at an ever-increasing rate.



Much has happened during these years. The first issue of the *Quarterly Review* of the National Electro-Platers' Association indicates that the members' interests were centered on decoration; it contains articles on antique finishes, various gold finishes, and lacquering, with one article on "The Electrical Side of Electroplating". The first issue of the *Quarterly Review* of the American Electroplaters' Society indicates a somewhat broader scope with three articles on copper and brass plating, one on cleaning stove parts, one on acid zinc plating, and several general articles. The Watts nickel bath, cyanide cadmium and zinc plating baths, and the chromium plating bath were to come later, not to mention modern pyrophosphate, fluoborate, and alkanesulfonate baths. The Society has grown with the development of the art and the industry.

Now our eyes should turn from the past to the future, to the 6,000 mark to start with, and then to the 10,000 mark. The membership has doubled in the last five years. If every member today is as conscientious about his membership as those of five years ago, the 10,000 mark should be reached in 1952. With the greatly increased values that the A. E. S. has to offer prospective members today, the goal should not be difficult to reach much earlier. Why not in 1948?

GUSTAF SODERBERG, *Editor*.

APOLOGY

Through an oversight in proofreading page proofs, the name of the senior author of the article on "Continuous Electrolytic Solution Purification" was spelled Heusser. All of our readers must have recognized that it should have been Heussner. Our sincere apologies.

STANDARDIZATION OF pH SCALE

The *p*H unit, used to express numerically the degree of acidity or alkalinity of aqueous solutions, may be defined in a number of ways, each resulting in a slightly different value for the *p*H of a given solution. Consequently, several *p*H scales, based upon various definitions, have met with equal favor among chemists. In view of the increasing need in science and industry for accurate determinations of acidity, the *National Bureau of Standards* is recommending the universal adoption of a single standard *p*H scale, analogous to the International Temperature Scale. It is proposed that the *p*H assigned to solutions of buffer substances distributed by the Bureau as *Standard Samples* be taken as the fixed points on this standard scale.

The several convenient *p*H meters now available commercially enable precise determinations of *p*H values in such media as electroplating solutions to be made with ease and rapidity, but these values are based upon a scale fixed by the *p*H assigned to the standards with which the instrument has been calibrated. The differences among scales of *p*H are the direct result of different procedures, definitions, and assumptions employed in arriving at the *p*H of the standard. The *p*H may be defined in one instance as the negative logarithm of the hydrogen-ion concentration or, again, of the effective concentration or "activity" of this ion. Often the *p*H value as defined by Sorenson in terms of the electromotive force of a galvanic cell with hydrogen and calomel electrodes is chosen. Although the differences among these scales rarely exceed 0.1 unit, the need for greater accuracy makes desirable the general adoption of a single series of consistent *p*H standards.

In an effort to encourage standard procedure in *p*H measurements, the National Bureau of Standards is now supplying four buffer materials in the form of *Standard Samples* of certified purity. These substances are acid potassium phthalate, potassium dihydrogen phosphate and disodium hydrogen phosphate (intended to be used together), and borax. They are being distributed at the rate of several hundred samples annually. The certificates furnished with these compounds specify the *p*H of certain aqueous solutions of the sample, which can provide fixed points on a *p*H scale.

In order to assign exact values to these fixed points, it was necessary to set up a scale based upon some suitable definition of *p*H. A consideration of the advantages and limitations of several scales led to a choice of a modified activity scale as most convenient and practical for general use. Although the activity of a single ionic species can be simply defined only in very dilute solutions, the influence of the hydrogen-ion activity in chemical equilibria is of far-reaching importance.

The *p*H of the NBS standards is derived from measurement of the electromotive force of cells without liquid junction, in which they are used as electrolytes. These cells are specially designed, utilizing the highly reproducible hydrogen and silver-silver chloride electrodes. Computation of *p*H is based upon several reasonable assumed relationships between ionic activities and mean activities. These assumptions are found to give identical values for dilute solutions The scale thus obtained approaches a true scale of activity for solutions of low concentration; at higher ionic strengths it is best regarded as a consistent scale which necessarily rests upon an assumption not subject to experimental proof.

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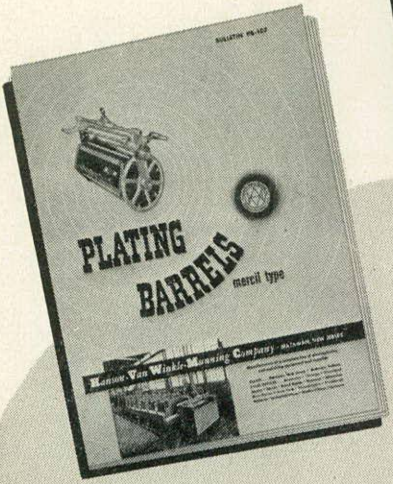

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BOOK REVIEWS

By DR. HAROLD J. READ

Associate Professor of Metallurgy—The Pennsylvania State College

CERAMIC WHITEWARES by Rexford Newcomb, Jr., 1947, xii + 313 pages. Pitman Publishing Corporation, 2 West 45th Street, New York, N. Y. Price, $5.00.

There has long been need for a clearly written, authoritative aad modern text dealing with the engineering properties and uses of the various types of pottery, porcelain, or china which are known as ceramic whitewares no matter what their end use, or incidentally, their color. The book by Mr. Newcomb meets these desiderata to a very satisfactory degree. His academic, industrial, wartime and publishing experiences have provided him with a comprehensive fund of information which has been skillfully organized and presented in the text.

The present reviewer is not qualified to assess the technical accuracy of the minutiae, but he has been assured by colleagues who are specialists in the field (one of whom is using the book as a classroom text) that aside from a few trivial errors, the volume is very satisfactory from this viewpoint. In any case, it is far superior to anything else which is available in this field.

The subject matter of the book is logically arranged, being headed by a concise but fascinating introduction written by Carlton Atherton. One would like to see this chapter expanded to a full book. The second chapter is a comparatively short discussion of silicate science, the comprehension of which may be rather difficult for those readers who are unfamiliar with equilibrium diagrams and phase rule studies.

The next fout chapters deal with the raw materials for ceramic bodies, the preparation of these materials, the forming and drying of the ware, and finally the firing. The treatment of these topics is particularly satisfying in that there is adequate detail without verbosity.

A section on properties and tests describes briefly but sufficiently all of the commonly accepted test methods used in determining the properties of fired ceramic wares, particularly as they are conducted under specifications set up by the A. S. T. M. and the A. S. A. Representative values of these properties are given.

The final step in the production of ceramic materials encompasses the glazing and decorating operations. This complicated subject is treated in 30 pages, but it is surprising to note how much information has been packed into the chapter.

The remainder of the book, approximately 100 pages, is devoted largely to the methods of utilizing ceramic whitewares. Their use in construction work and in the home is described in discussions of tile, sanitaryware, table service, kitchenware, containers and artware. Whiteware products find extensive use in the electrical industry, and are classified in a chapter on this application according to their properties as insulators. A section on the miscellaneous industrial uses of whitewares is organized on the basis of the resistance of the various types of bodies to abrasion, heat, or chemical attack. The latter subject should be of particular interest to the electroplater. The final chapter deals with the sources, properties, manufacture and uses of abrasives. It is too brief to be of more than passing interest to the metal finisher.

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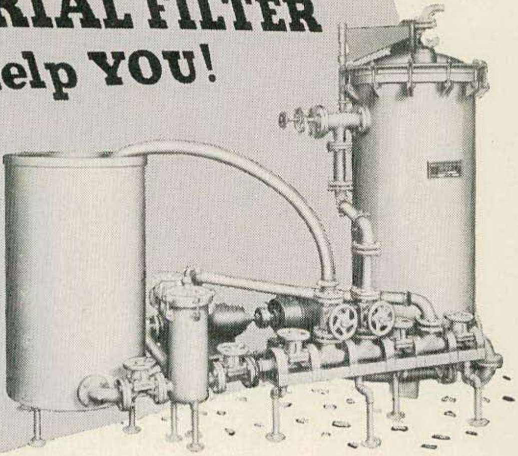

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Chairman, Program and Educational Committee

Phenomena of Adsoprtion and Desorption Taking Place on the Surface of Iron After Acid Electrolytic Surface Treatment

PAUL BASTIEN, SIMON MISCHNONSNIKY, and CHANTAL DE SENNEVILLE. *Comptes Rendus* **224**, 126–127 (January 13, 1947).

Pickling of iron, by cathodic means or using an acid bath, causes an increase in the hydrogen content of the metal and the elimination of surface oxides. Such a surface possesses high resistance to the adsorption of air. Investigations were performed to prove this assumption and to establish the relation between the adsorption and desorbtion of air and hydrogen.

A New Process for Electropolishing Silver

DANIEL GRAY and S. E. EATON. *Iron Age* **159**, 64–65 (April 10, 1947).

Process described employs a current in a direction opposite from that employed in normal plating, is performed in an alkaline cyanide bath without removing the parts from the original plating racks, and results in a complete polish up to mirror brightness.

Finishing Copper by Oxidation with Sodium Chlorite

WALTER R. MEYER and G. P. VINCENT. *Metal Finishing* **45**, 61–63, 71 (March 1947).

Oxide finishing of copper and its alloys by use of sodium chlorite and alkali is described. An immersion process, it not only prevents further oxidation of the surface but acts as an excellent base for organic coatings due to the toothing of the surface caused by the oxidizing reactions. Pretreatment preparation of the metal is given, and control conditions of the bath explained.

The Chemical Surface Treatment of Magnesium Alloy Sheet for Spot Welding

W. F. HESS, T. B. CAMERON and D. J. ASHCRAFT. *Welding* **26**, 170s–190s (March 1947).

Before spot welding, the protective oil or chrome-pickle coating must be removed. Previously this had to be done mechanically. Various solutions were investigated in an attempt to develop a satisfactory chemical procedure. Cleanliness of the sheet was evaluated by measuring sheet-to-sheet electrical resistance. A satisfactory solution for sheet obtained from two manufacturers consisted of 10 per cent CrO_3 containing 0.05 per cent Na_2SO_4. Many tables and charts give details of results. 12 ref.

Electro-Tinplate

I. The Influence of Plating Conditions on the Quality of Electro-Tinplate Deposited from the Stannous Sulfate Bath

R. M. ANGLES, K. W. CAULFIELD, and R. KERR. *J. Soc. Chem. Ind., Trans. Comm.* **65**, 430–433 (1946).

The quality of tinplate formed under different plating conditions from the stannous sulfate-cresolsulfonic acid bath was compared by the thiocyanate and hot-water porosity test and by exposure in a humidity chamber. Within the ranges examined, the quality improves with increase of tin concentration of the electrolyte and with decrease of current density. Optimum concentration of acid depends on tin content. Raising the temperature impairs the quality of the deposits. No significant improvement was obtained by addition of commercial wetting agents.

Electro-Tinplate

II. The Influence of Coating Thickness on the Porosity and Resistance to Corrosion of Electro-Tinplate

III. The Influence of Pickling Conditions on the Porosity and Corrosion Resistance of Electro-Tinplate

K. W. CAULFIELD, R. KERR, and R. M. ANGLES. *J. Soc. Chem. Ind., Trans. Comm.* **66**, 5–11 (January 1947).

In Part II, study was made of effect of variation in coating thickness on quality of electro-tinplate deposited from stannous sulfate and sodium stannate baths. Curves show influence of coating thickness on thiocyanate, hot-water porosity, humidity, and salt-spray test values, and effect of time of exposure out-of-doors on weight increment for a range of coating thicknesses. In Part III, quality of coatings from alkaline and acid baths was determined following different pickling treatments. Inhibited sulfuric acid was found to be best for alkaline-bath deposits, anodic etching in sulfuric acid best for the acid-bath type. Details are tabulated.

Metallography for the Electroplater

ALEX BLAZY and J. B. MOHLER. *Metal Finishing* **45**, 54–57 (April 1947).

Techniques in metallography for the examination of electroplated coatings are described. Equipment necessary for this type of work is investigated in some detail, and an explanation of microscopic methods of interpreting electrodeposited coatings is given. Tables list necessary etching reagents for common metals and alloys and give directions for their use.

Surface Area of Chrome Plated Nickel

CALLAWAY BROWN and HERBERT H. UHLIG. *J. Am. Chem. Soc.* **69**, 462–465 (1947).

Low-temperature absorption of inert gas was the technique used to measure true "accessible" area of chrome plated surface, as opposed to apparent area. Technique and results are described. Results show 10 to 50 times as much "accessible" area as apparent area.

Tin as a Coating Material in the Wire Industry

BRUCE W. GONSER. *Wire and Wire Products* **22**, 207–210, 242–243 (March 1947).

Discusses hot tinning, electrolytic tinning, replacement from aqueous solutions, replacement in molten salt, and some unusual applications of tin coatings. 15 ref.

The Electrolytic Polishing of Carbon-Manganese Steels

W. A. SPARKS. *J. Electrodepositors' Tech. Soc.* **21**, 245–264 (1946). (Reprint.)

Gives a full description of a series of experiments carried out to develop a process capable of being operated on a commercial scale with a minimum of technical control over the variables. Effects of various addition agents and the choice of steels are described.

Metal Coating of Plastics by Vacuum Evaporation Techniques

F. C. BENNER. *Electrical Manufacturing* **39**, 107–109 (March 1947).

The metallizing of plastics parts in electrical products is discussed in this article.

Electrostatic Spraying of Steel Wall Panels

W. S. REED. *Materials and Methods* **25**, 77–79 (February 1947).

Describes equipment and procedures in the application of finish coats through the use of electrostatic spraying and infrared drying.

The Color Anodizing of Aluminum

G. T. COLEGATE. *Metål Treatment* **13,** 248–264 (Winter 1946–1947).

Describes the various anodizing methods available, the dyes and other pigments used, and the practical control of the processes.

Ammonia in Brass Plating Solution

S. BUCHAN and W. D. RAE. *IRI Transactions* **22,** 221–226 (December 1946).

A common method for bonding rubber to metal is by means of an intermediate layer of electrodeposited brass. One of the most important factors controlling the type of deposit, which in turn influences the quality of the rubber-metal adhesion, is the ammonia content of the plating solution. The mechanism of the action of the ammonia was investigated by a unique method, which is described. Results are tabulated, charted, and evaluated. It was found that while ammonia reduces the efficiency of deposition, it also increases the throwing power of the solution and produces a more uniform deposit.

Mirror Bright Copper Plating

JOHN ANTHONY. *Iron Age* **159,** 54–55 (February 13, 1947).

Describes a brightener solution which when added to the conventional copper cyanide plating bath offers promise of lower plating costs by eliminating the need for buffing copper deposits and serves to cut down the racking and handling time in the plating shop.

Fusing of Electrodeposited Tin Coatings

J. FALK. *Metal Finishing* **45,** 63–65, 71 (April 1947).

Sinplified method of obtaining extremely lustrous electroplated tin finishes by fusing of thin coatings is explained in detail. Equipment necessary to perform this operation is listed and control conditions given. Fused electroplated tin coatings give not only brilliance but, theoretically, have higher corrosion resistance because of less porosity than non-fused coatings.

Tin Plating and Control of Tin Solution by Anode Color

JOHN FRANKLIN DAYMUDE. *Products Finishing* **11,** 42–44, 46, 48, 50, 52, 54, 56 (March 1947).

Presents instructions for the operation of a low-caustic, low-temperature tin-plating solution. Plating solution under consideration is applicable to a wide variety of base metals and possesses excellent throwing power.

Magnetic Particle Inspection of Chromium Plated Tools

H. M. MUELLER and W. E. YEAST *Metal Progress* **51,** 420–425 (March 1947).

Tells how change in the equipment and technique of magnetic inspection together with draws at 350° F to relieve internal stresses brought rejects from around 50 per cent to 0.5 per cent in an epidemic of broken tools used in the manufacture of small-arms ammunition.

Abrasive Finishing of Plastics

ANON. *Materials and Methods* **25,** 119 (March 1947).

Tabular summary of a series of case studies involving the abrasive finishing of plastic parts.

The Cronak and Similar Processes

P. C. SMETHURST. *Process Engravers' Monthly* **54,** 58, 61 (March 1947).

In the Cronak process for treatment of photolitho zinc sheets before use in order to avoid scumming during printing, the sheets are placed in an ammonium dichromate-sulfuric acid bath for 30 seconds. The chemical mechanism of this and similar processes is discussed, and a recent letter by L. P. Clerc relative to the possible invalidity of the Cronak patent is commented upon.

Electroforming (Concluded)

E. A. OLLARD. *Metal Industry* **70,** 126–128 (February 14, 1917).

Methods employed for producing electroformed articles are illustrated by several typical examples.

Bright Chromium Plating and Temperature Control

M. G. HERBACH and C. W. BOWDEN, Jr. *Metal Progress* **51**, 257–259 (February 1947).

Discusses types of chromium plate, preparation for plating, control of cleaning baths, chromium plating process, control of chromium plating, details of control system, installation.

Quick Guide to Solutions for Stripping Metal Overlays

J. B. MOHLER. *Iron Age* **159**, 66–67 (May 8, 1947).

A quick guide to the selection of the solution most suitable for stripping a given plate from a specific base metal is given. Solutions listed are arranged in order of preference. Makeup of the solutions listed is given in table. Tables present recommended methods, but may also be used to select stripping solutions for experimentation where no recommendations are given.

Selenium Rectifiers

JULIAN LOBENSTEIN. *Machine Design* **19**, 112–114 (March 1947).

Increased-size plates capable of sustaining much higher voltage make them more useful as dry-plate rectifiers for miscellaneous applications which are described. General characteristics of various types of rectifying equipment are tabulated.

Plating and Anodizing Aluminum

ANON. *Light Metals* **10**, 17–19 (January 1947).

Deals with bath compositions for electrodeposition on aluminum and with limitations of the anodic process as a method for finishing domestic ware.

Electroplating and Cathodic Pickling as Causes of Hydrogen Embrittlement

CARL A. ZAPFFE and M. ELEANOR HASLEM. *Wire and Wire Products* **22**, 351–356, 379–381 (May 1947).

Describes a new bend test said to be especially suitable for measuring brittleness of wire specimens. Demonstrates the effects of pickling time, bath temperature, and bath impurities on hydrogen embrittlement during cathodic pickling. Shows that hydrogen absorption is identical for acid or for alkaline electrolytes. Gives a quantitative evlauation of embrittlement caused by chromium plating and by cadmium plating, both of which are shown to cause embrittlement equaling or exceeding that caused by cathodic pickling.

Tests for Adhesion and Hardness of Surface Coatings

H. GRINSFELDER. *Organic Finishing* **8**, 38–42 (April 1947).

Presents study of the accuracy and reproducibility of five widely used tests for adhesion and hardness of surface coatings made in the laboratories of The Resinous Products and Chemical Company of Philadelphia. Tests studied were the Sward Hardness Rocker, the Pencil Method, the Modified Bell Laboratory Mar Adhesion Test, and the Finger Nail and Knife Scratching Tests.

High-Solids Metal Lacquers

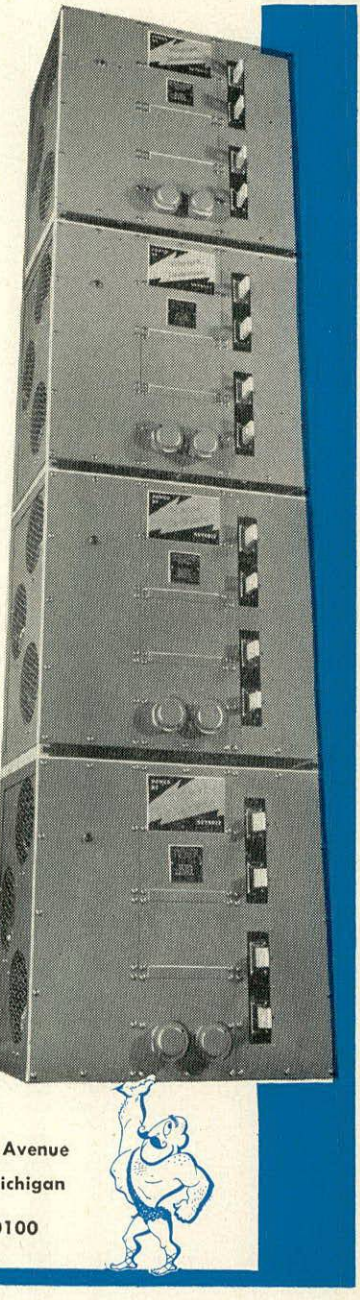
J. K. SPEICHER. *Canadian Chemistry and Process Industries* **31**, 214–217 (March 1947).

Discusses various methods used to increase the solids content of lacquers, thus reducing the amount of solvent required. Data are presented concerning resins which in combination with nitrocellulose give low viscosity solutions and which can be used in high proportions relative to nitrocellulose and still give durable lacquers. Includes results of two-year outdoor-exposure tests.

A New Anti-Cementation Coating

L. M. KAMIONSKY. *Engineers' Digest* (American Edition) **4**, 157 (April 1947). Condensed from *Vestnik Mashinostroenia* Nos. 2 and 3, 71–72 (1946).

Describes a protective mixture which deposits a layer of copper on metal parts for which electroplating is not convenient or practicable.




Wagner
Tiedeman

PATENTS

By GEORGE B. HOGABOOM

Consultant, New Britain, Conn.

No. 2,428,404, October 7, 1947—Electrodeposition of Molybdenum-Cobalt Alloys—L. F. Yntema, assignor to St. Louis University, St. Louis, Mo.

The following is an example of a suitable electrolyte for codeposition of an alloy of molybdenum and cobalt in accordance with my invention:

	Range	*Optimum*
Water, liters	1	1
Sodium molybdate, grams	10–30	20
Cobalt sulfate, grams	5–15	10
Sodium hydroxide, grams	100–300	250
Sodium carbonate, grams	40–120	80
Dextrose, grams	10–30	20
Temperature	Room	
Current density, amp/dm^2	0.03–0.5	

CLAIM 2. The process for electrocodepositing an alloy of molybdenum and cobalt which consists in passing a current between an anode and the work to be plated as a cathode in an aqueous electrolyte consisting essentially of 10 to 30 grams per liter of hexavalent molybdate compound, 5 to 15 grams per liter of a soluble cobalt compound, 100 to 300 grams per liter of free alkali metal hydroxide, and 10 to 30 grams per liter of an organic compound having a hydroxyl group of the class consisting of sugars, glycerine, glycols and tartaric acid.

NOTE: The molybdenum-cobalt plates are very bright, very hard and adherent, and are resistant to tarnishing and to the action of a 3 per cent sodium chloride solution.

5 Claims.

No. 2,429,902, October 28, 1947—Apparatus for Producing Electroplated Sheets—M. M. Sternfels, assignor to Chromium Corporation.

CLAIM. An apparatus for producing electrolytic metal foil which comprises a tank containing a metal plating bath, a metal drum having a cylindrical, electrolytically conducting surface with insulated ends substantially flush with said conducting surface mounted so that a portion of its surface dips into said baths, means for rotating said drum, at least two endless insulating masking tapes spaced parallel and mounted in such a fashion as to wind unto and unwind from said drum while engaging the immersed surface of said drum and covering the joints between the insulated ends and the conducting surface of the drum, thereby forming two insulated bands of drum surface separated by a conducting band, an anode, means for passing an electric plating current through said anode to said conducting band serving as cathode, whereby a deposit of electrolytic metal forms on said conducting band, means for continuously stripping said electrolytic deposit from said drum, means for separating said masking tapes from the drum surface, a tank containing cleaning liquid, means for passing said tapes into and out of said cleaning liquid while they are unwound from said drum, and means for conveying the cleaned tapes back to be rewound on said drum.

1 Claim.

No. 2,429,970, October 28, 1947—Silver Plating—C. J. Wernlund and J. R. Macon, assignors to E. I. du Pont de Nemours & Company.

Claim 1. A process for producing bright silver electrodeposits which comprises electrolyzing a silver-alkali metal cyanide solution containing an organic sulfur compound selected from the group consisting of 2-mercaptobenzothiazole, 2-mercaptothiazole, 2-mercaptothiazoline, thioacetanilide, and trimercaptocyanuric acid in an amount sufficient to brighten the deposit within the range of 0.001 to 1 oz per gallon.

Example 1. Silver was plated from the following solution maintained at a temperature of 27° C to which was added 2-mercaptobenzothiazole.

Silver cyanide..........	10 oz/gallon
Potassium cyanide......	17 oz/gallon
Potassium hydroxide....	0.25 oz/gallon

Bright deposits were obtained at the current densities indicated below.

2-Mercaptobenzothiazole Concentration oz/gallon	*Current Density Bright Range* amp/sq.ft.
0.040	5–30
0.054	4–60
0.067	5 to over 70
0.134	6 to over 70

5 Claims, 6 Examples.

No. 2,429,976, October 28, 1947—Electrolyte for and Method of Anodically Polishing Nickel—C. L. Faust, assignor to Battelle Memorial Institute.

Claim 1. An electrolyte for use in the anodic polishing of nickel comprising from 5 to 85 per cent by weight of sulfuric acid and from 5 to 85 per cent by weight of orthophosphoric acid, the combined content of these acids being at least 50 per cent but not over 90 per cent by weight of said solution, 0.5 to 2.6 per cent by weight trivalent aluminum, and 0.5 to 1.4 per cent by weight trivalent chromium, the balance comprising essentially water.

Data in Legend: The percentage compositions and operating temperatures of specific baths according to the present invention are tabulated as follows:

	Bath			
	No. 1	*No. 2*	*No. 3*	*No. 4*
H_2SO_4 ..	14.5	14.9	13	10
H_3PO_4...	60.6	62.3	56	62
Al^{+3}.....	2.4	0.5	2.6	2.2
Cr^{+3}....	1.3	0.3	1.4	None
Ni^{+2}....	0.5–1	0.5–1	0.5–1	0.5–1
Water...	Balance	Balance	Balance	Balance
Operating Temperature, °F....	175	115–130	115–130	175

6 Claims.

No. 2,428,804, October 14, 1947—Copper Cleaning Composition—Esther M. Terry and M. Kaplan.

Claim. A copper cleaning composition comprising approximately 5 parts by weight of sulfuric acid, 4½ parts of 30 per cent hydrogen peroxide, 3 parts of acetic acid, and 87½ parts of water.

1 Claim.

No. 2,429,222, October 21, 1947—Method of Making Contact Wires—R. A. Ehrhardt and R. G. Humphrey, assignors to Bell Telephone Laboratories.

This invention relates to translating materials and devices and particularly to methods of making them.

The objects are to reduce the cost of manufacture contact wires for translators; to improve the electrical contact between the contact wire and its supporting member in assembly; to facilitate the joinder of this wire and the supporting member by soldering or otherwise.

Claim 2. The method of preparing contact wire for rectifiers which comprises moving an indefinite length of tungsten wire at a predetermined rate through an electrically energized cleaning bath containing an agent suitable for cleaning and etching the wire, said wire being made the anode in the cleaning bath, rinsing said wire, moving said wire through an electrolytic bath including a nickel salt and hydrochloric acid for cleaning the wire and giving it a strike coating of nickel, said wire being made the cathode in said electrolytic bath, rinsing said wire, moving said coated wire at a predetermined rate through a second electrolytic nickel plating bath for depositing on said strike coating a plating of nickel of substantial thickness, moving said plated wire at a predetermined rate through a third electrolytic bath containing gold for depositing on said nickel plating a plating of gold of substantial thickness, and subjecting said plated wire to a heat treatment of 710° C to cause a portion only of the gold plating to alloy with the nickel plating, to cause a portion only of the nickel plating to alloy with the tungsten body of the wire, and to cause a portion only of the gold plating to alloy with the nickel plating.

5 Claims.

BRANCH NEWS

Coming Events

BOSTON BRANCH

The thirteenth annual meeting will be held on Saturday, April 17, 1948. Reserve the date.

George P. Swift, *Secretary.*

DETROIT BRANCH

EDUCATIONAL SESSION
and DINNER-DANCE

December 6 in Hotel Statler

2:00 P. M. Symposium on Plating Plant Engineering, A. E. S. Past President Walter J. Pinner in the chair.

(1) "*General Plating Plant Engineering*" by L. Moye, Engineer, The Utley Company

(2) "*D. C. Power Transmission and Piping*" by George L. Nankervis, President, George L. Nankervis Company

(3) "*The Practical Significance of Good Power Transmission*" by L. C. Borchert, Technical Manager, Houdaille-Hershey Corporation

(4) "*Ventilation*" by Victor P. John, Manager, Industrial Division, American Blower Company

(5) "*Filtration*" by G. M. Cole, Chemical Engineer, Fisher-Body-Ternstedt Division, General Motors Corporation

7:00 P. M. Dinner-Dance and Entertainment. Tickets at $7.50 each may be had from

F. L. Clifton, *Secretary-Treasurer.*

GRAND RAPIDS BRANCH

ANNUAL EDUCATION SESSION
AND DINNER DANCE

Pantlind Hotel—January 24, 1948

Educational Session

Furniture Club Room—2:00 P. M.

Chairman
Mr. Kenneth M. Huston
Supreme President A. E. S.

Speakers

Mr. Robert M. Wagner
Superintendent of Manufacturing Processes,
Guide Lamp Division
General Motors Corporation
Subject to be announced

Dr. Walter R. Meyer
Technical Director, Enthone, Inc.
"Preparation of Metals for Electroplating"

Dr. Harold J. Read
Associate Professor of Mineralogy,
Pennsylvania State College
"The Microstructure of Thin Deposits"

Dinner Dance

Main Ballroom—7:00 P. M.

Mr. J. J. Hanney, Ticket Chairman
1105 Dickinson Street, S. E., Phone 5-4310
Capacity 500. Get your tickets early.

Jacob M. Hage, *Secretary.*

BALTIMORE-WASHINGTON BRANCH

Dr. D. Gardner Foulke of Hanson-Van Winkle-Munning Company, Matawan, N. J., spoke on "Periodic Reverse Current Electroplating" at the October meeting at the National Bureau of Standards. Interesting photomicrographs were shown to illustrate the structure of the deposits. Thirty-eight were present.

Grace Riddell, *Secretary.*

BUFFALO BRANCH

Mr. E. R. Bowerman of Sylvania Electric Products spoke about "Engineering in the Plating Room" at the October 10 meeting.

Mr. Bowerman's talk struck home with all who heard him because he stressed efficiency in the plating room through proper design of equipment. He covered such subjects as ventilation, heating, electrical power supplies, filtration, and plumbing. The talk was illustrated with lantern slides.

The discussion that followed brought out many of the legal aspects of ventilation in the plating room. The disposal of plating room wastes also received a goodly share of attention.

Any of the branches who have not as yet heard Mr. Bowerman should strive to do so. He has a wealth of experience and knowledge which will leave an impression upon anyone who is interested in commercial electroplating.

H. A. Fudeman, *Secretary.*

BRIDGEPORT BRANCH

Forty-six members and guests were present a the October 3 meeting.

Charles Temple, Chairman of the Membership Committee, reported five applications for membership. One applicant was elected.

President Gotthardt and A. R. McNeil are to investigate the purchase of a slide projector and report at the next business meeting.

Charles L. Temple, A. R. McNeil, Carl Schaefer, and H. M. Goldman were appointed to the Constitution Revision Committee.

Librarian A. J. Chenis showed *Date Line of Tomorrow*, a picture with sound of the progress in the Aluminum Industry during the past twenty-five years.

Joseph Ganim suggested the possibility of forming a plating class in the Central High School, sponsored by the Bridgeport Board of Education. An instructor, Jerry Delaney, would take care of a class providing that a minimum number of fifteen would attend. Jerry Delaney will attend one of our meetings and state his views.

Joseph G. Sterling,
Secretary-Treasurer.

BRIDGEPORT BRANCH

An Open Meeting and Educational Session was held on October 17 in Burrough's Public Library Auditorium. In the absence of President F. B. Gotthardt, Vice-President C. L. Temple opened the meeting with sixty-one members and guests present.

Technical Chairman A. J. Chenis introduced Mr. J. H. Shoemaker of the Kolene Corporation of Detroit, Mich., who presented a paper describing the Kolene process. This process makes use of molten salt, heated by electric immersion heaters or gas-fired equipment, as a dip or electrolytic treatment for cast iron, gray iron, alnico, etc., in preparation for electroplating, brazing, and silver soldering.

The talk was supplemented with slides showing photo-micrographs of treated specimens and also installations throughout the country. A considerable amount of discussion followed.

Joseph G. Sterling,
Secretary-Treasurer.

CHICAGO BRANCH

The Chicago Branch continued its monthly meetings during the summer. The July meeting was devoted to Delegates' reports of the Convention and discussion of the proposed Constitution. A short movie dealing with rayon manufacture completed the meeting.

At the August meeting, our Secretary, Mr. J. Andrus, delivered a very good paper on anodizing aluminum. The talk was illustrated with slides and exhibits of various applications of anodizing.

The September meeting was devoted to conversion coatings on zinc plated articles. Our former librarian, **Mr. W. C. Carter**, gave an excellent account of the chromate coatings. The paper was complete with data on salt spray resistance to formation of white corrosion products and to complete failure by the formation of rust.

There was a very large attendance at the October meeting when **Mr. Joseph Niles** spoke about modern brass plating. A lively discussion followed and the members felt that the subject had been thoroughly covered.

J. H. Monaweck, *Librarian.*

COLUMBUS BRANCH

Some forty members and guests, among whom were **Mr. John Ireland**, Manager of the Tin Research Institute of Greenford, England, and **Dr. Ernest S. Hedges**, Scientific Director of Research of the Tin Research Institute, attended the meeting in Battelle Memorial Institute on October 3.

The speaker of the evening, **Dr. R. A. Schaefer**, Director of Research, the Cleveland Graphite Bronze Company, presented some interesting details of the development of electrodeposition of lead, tin, silver, and their alloys on bearing surfaces.

A very short business meeting followed Dr. Schaefer's address.

Arch B. Tripler, Jr.,
Second Vice-President.

GRAND RAPIDS BRANCH

Our second meeting of the 1947–1948 season, held at the Grand Rapids Varnish Corporation on October 10, was a plant visitation.

The members were taken on a tour of the Corporation's new offices and laboratory building and were highly impressed by the greatly expanded facilities, including fine laboratories and space devoted to compounding, physical testing, research, etc. After the tour, **Mr. Wayne Fuller**, Research Chemist, presented a timely and interesting talk on testing of organic finishes.

Refreshments were served by the Corporation.

Jacob M. Hage, *Secretary.*

JACKSON-LANSING BRANCH

The first meeting of the 1947–1948 season was held September 9, 1947 in Hotel Porter, Lansing. This meeting inaugurated a new system: The Annual Educational Session and Party are to be foregone to allow more emphasis to be placed on the monthly meetings. Individual companies supplying the metal finishing industry have been requested to sponsor meetings and help make a particular meeting successful from a standpoint of attendance, attractiveness, pleasure, and educational value.

Frederic B. Stevens, Inc., were the sponsors of this, the first meeting. After an excellent dinner and a good cigar, **Mr. L. R. Eastman**, Manager of the Composition Department, discussed "New Developments in Polishing and Buffing." His talk encompassed the field of buffing and polishing compositions, and was highlighted by a call for finish standards.

The second feature was a talk by **Mr. G. A. Cummings** of the Engineering Department on "The Electric Side of the Plating Plant." He brought out the surprising savings that can be made with an up-to-date generator and, with the use of slides, explained how the savings were effected by modern design. His discussion was very instructive to those of us who have taken the direct current source for granted.

Many favorable comments were heard after the meeting about both speakers and sponsor.

U. J. Forsyth,
Secretary-Treasurer.

LANCASTER BRANCH

The regular monthly meeting was held Friday, October 10, in the Stevens Trade School. In the absence of our president, the meeting was called to order by **Vice-President Charles Snyder**. There were twenty-five members and guests present.

Two applicants were elected to membership, and two applications were referred to the Board of Managers.

Our Librarian, **Chester Smith**, introduced the speaker, **Mr. A. E. Carlson** of the General Chemical Company, who spoke about "High-Speed Plating from Fluoborate Solutions". He first discussed the process for making the master disc used in phonograph record manufacturing in which copper is deposited from a copper fluoborate solution on a plastic disc to a thickness of 0.030 inch. Plaques are made in the same manner. Mr. Carlson passed among the group a few plastic articles that had been plated in a copper fluoborate solution. Some of the advantages of a fluoborate solution are: the operation is simple (hot or cold), composition of the bath is not critical, and higher current densities are permissible. Slides were used to show the composition of different fluoborate baths and the properties of the deposits under certain conditions.

H. Clay Brubaker, *Secretary.*

LOS ANGELES BRANCH

The October meeting was held at Scully's on Monday, October 13, with approximately seventy-five members and guests attending.

Treasurer George Kent reported that eighteen members were more than one year in arrears for dues and forty-eight members delinquent for a year or less, a total of sixty-six members whose delinquency amounts to $483 at this time.

Earl Coffin announced the appointment of the 1948 Banquet Committee and summarized the work to date.

Speakers of the evening were the Los Angeles delegates to the Detroit Convention. **Jack Raskin** reviewed a number of the more interesting and pertinent papers presented at the Educational Session.

Leo Atimion described some of the procedures used in the East, emphasizing the method of disposing of industrial waste used by the Electrolux Company in Stamford, Conn.; the burnishing methods used in the manufacture of jewelry at Providence, R. I., and Attleboro, Mass.; and the research work being done in the Detroit area. **Don Bedwell** told of his experiences and observations at the Crane Company in Chicago and the Ternstedt Division of General Motors in Detroit, covering in some detail the plating procedures used on zinc die castings.

The Question Box contained the following:

Q. 1. What is the formula for the nickel strike used in replating rejected plated steel parts? A. Nickel chloride, 25 oz/gal; Nickel sulfate, 8 to 10 oz/gal; *p*H, about 1. Strike for 30 seconds.

Q. 2. How heavy a plate is used on plumbing goods? A. Normally not less than 0.0003 inch.

Q. 3. How much current is used in chromium barrel plating? A. At 10 to 12 volts a three-pound load will draw about 400 amperes.

Q. 4. In the sodium zincate process for preparing aluminum for plating, can anything but carbon brick be used for the hydrofluoric-nitric dip? Can cast alloys be plated satisfactorily without using this dip? A. Apparently not.

Q. 5. When pickling high-carbon galvanized steel wire to remove rust and scale, is it possible to remove the smut formed on the wire so as to permit plating? A. Try concentrated nitric acid, cut with zinc and diluted to 20 per cent with water.

The Branch voted to approve the amendment raising the annual dues by two dollars. **Don Bedwell**, **Walter Behlendorf** and **Roy Lostutter** were appointed to the New Constitution Committee.

Al Speser and **Frank Rushton** were reported as still being hospitalized.

Dean D. Williams, *Secretary.*

MILWAUKEE BRANCH

The Milwaukee Branch held its 381st regular meeting on October 3, 1947. **Mr. William Geissman** was elected committee chairman for the 1949 National Convention in Milwaukee. **Mr. Les Dively**, in a statement on the progress of the electroplating classes at the Vocational School, reported that classes are full and there is a waiting list. **Dr. Chester** of Poor and Company was the evening speaker. His subject, "The Alchemy of Electroplating", proved very interesting. He reviewed the history of electroplating and challenged present-day platers to push forward in this field which has shown much progress but still offers much opportunity for improvement.

JAMES DURNFORD, *Secretary.*

MONTREAL BRANCH

Sixteen members were present when MR. P. M. COADY of the RCA Victor Company addressed the October 7 meeting on "Electroless Plating". Following a short review of the history of the process, he explained the theory of plating without the electric current by reduction of a metal salt with sodium hypophosphite, the reaction being catalyzed by certain base metals. The speaker, assisted by MR. J. D. FAIRBAIRN, then gave a demonstration by plating bright nickel on steel. Mr. Coady closed by outlining the limitations of the process.

WILLIAM GLOVER, *Secretary.*

NEW YORK BRANCH

One application for membership was received and six new members elected at the regular meeting on October 10. The Executive Board outlined a program for the near future which received unanimous approval. LIBRARIAN MARTIN MAHER conducted the question box which, as usual, created a lively discussion.

Five more applications for membership were received and another member was elected on October 24. At this meeting Librarian Maher introduced the two extemporaneous speakers. MR. GEORGE HERRMAN, a member of this Branch, gave a most fascinating talk on "A Plater's Method of Solving a Tough Engineering Problem," which dealt with the intricacies of diamond dental burr manufacture.

MR. MILTON NADEL, also a member of this Branch, described the manufacturing obstacles that had to be overcome in the mass production of finished Venetian blind stock and steel tape rules.

ALBERT C. FUSCO,
Recording Secretary.

PHILADELPHIA BRANCH

PRESIDENT ORLIK called the October meeting to order with fifty members present.

Ten applications were referred to the Board of Managers, and three applicants were elected to membership

NAT VERRELLE reported GEORGE GEHLING sick in the Episcopal Hospital, Philadelphia.

LIBRARIAN HIRSCH introduced MR. JOSEPH MAZIA, Metallurgist, American Chemical Paint Company, Ambler, Pa., a member of the Branch, whose subject was a "New Method of Preparing Zinc Alloy Die Castings for Plating". Mr. Mazia began by giving the compositions of the castings and the reasons therefore, the different methods of polishing and preparatory methods used in and around Detroit. He then discussed his company's new product, an acid emulsion type cleaner used at 140° F prior to the conventional mild alkali type, which this writer saw demonstrated in a Detroit plant during the Convention Week. It is especially useful where a baked enamel finish is used after plating.

PAUL MENTZER, SR., *Secretary.*

PITTSBURGH BRANCH

The attendance at the October 9 meeting in the Keystone Hotel was about sixty, of which thirty-five were present at the dinner which preceded the meeting. Not less than three National Officers, FIRST VICE-PRESIDENT JOHNSTON, SECOND VICE-PRESIDENT LOGOZZO, and EXECUTIVE SECRETARY GRAHAM were there.

FRANK KELLER reported on the work of the Branch's Constitution Revision Committee. Mr. Logozzo discussed the work of the National Constitution Revision Committee, of which he is chairman. PRESIDENT HENNESSY told of the Referendum Vote being taken on an amendment to the Constitution which will increase the annual dues by $2.00 per year, the additional amount to go to the National Society. The Branch voted unanimously to instruct our three delegates to vote in favor of this amendment. DR. LANCY discussed the courses in electroplating initiated by the Pittsburgh School of Plastics.

Twelve new members were elected.

LIBRARIAN GOLDBACH then introduced Mr. Arthur W. Logozzo of the Nutmeg

Chrome Corporation, A. E. S. Second Vice-President, who spoke about "Bright Nickel and Decorative Chromium Plating". He showed a wide acquaintanceship with practical methods and illustrated his talk with slides of various cleaning, pickling and plating practices, as well as racking arrangements for carrying out the cycles without unracking or polishing. He answered a great many questions which were asked during the discussion period.

The display this month was by the *East Liberty Electroplating Company* and included a wide variety of plated articles.

RICHARD A. DIMON,
Secretary-Treasurer.

PROVIDENCE-ATTLEBORO BRANCH

MR. L. G. CHESWORTH of United Carr Fastner of Boston was the speaker of the October meeting.

His paper, "Barrel Bright Nickel and Zinc Plating", covered in full detail all points which differed from the usual barrel plating, namely, current density, brightener content, temperature, and electrolytic purification. It was based on a year and a half of experience with large scale production.

EDWARD A. PARKER, *Secretary.*

ROCHESTER BRANCH

Seven applicants were elected to membership at the October 17 meeting.

MICHAEL PAVONE has returned from Military Service and was reinstated.

LIBRARIAN CHARLES HENDERSHOTT introduced the speaker, MR. SIEFFEN of the J. J. Sieffen Company, who spoke about "Sprayed-on Buffing Compounds and Abrasives". The technique of using emulsified compounds in a gun mounted over the buffing wheels and the numerous applications of this method were brought out. The advantages of this method and time and cost comparisons against other methods of applying compounds were emphasized.

Forty-seven members and guests were present and asked Mr. Sieffen numerous questions.

JAMES E. WEAVER, *Secretary.*

ST. JOSEPH VALLEY BRANCH

There were twenty-seven present at the dinner and thirty-one at the technical session on September 3. Hotel Elkhart was designated as the permanent meeting place of the Branch.

MR. L. E. WEEG introduced DR. R. A. SCHAEFER of the Cleveland Graphite Bronze Company who gave a talk on silver, lead and lead-tin plating, illustrating the talk with slides. He then showed movies of the processes used at Cleveland Graphite Bronze Company for making bearings.

HAROLD J. WIESNER,
Secretary-Treasurer.

ST. JOSEPH VALLEY BRANCH

The regular monthly meeting was held on October 1 at the Hotel Elkhart. Forty members and guests attended the dinner. There were forty-four at the business and technical session.

One application for membership was approved, and three new applications were received.

LIBRARIAN V. E. PETERSON introduced the speaker for the evening, MR. C. W. CARTER of United Chromium, Inc. Mr. Carter gave a very excellent paper on "Hard Chromium Plating," which covered methods of preparation of basis metals, solution composition and operating conditions, and plate thicknesses recommended for various types of parts.

An interesting question period followed.

HAROLD J. WIESNER,
Secretary-Treasurer.

SAN FRANCISCO BRANCH

A regular monthly meeting was held in the El Curtola Restaurant, Oakland, on October 9. Fourteen members and one guest attended.

MR. E. MARCUM, Technical Director, Western Division, E. I. du Pont de Nemours & Company, gave a comprehensive and well-presented talk on "High Speed Bright Zinc Plating," illustrated with slides.

DELEGATE PATTENGER was instructed to vote in favor of the proposed $8.00 annual dues. Members of San Francisco Branch are in favor of retaining the old constitution "as is", with such amendments as may be deemed necessary in the future.

President Fred Huntington appointed as a committee to plan a Christmas party J. R. Pattenger and Frank Cavallera.

Jack Hite, *Secretary-Treasurer.*

SOUTHEASTERN BRANCH

The meeting on October 15 at the Roebuck Country Club proved a huge success. Following a tasty chicken supper, the forty members and guests had the opportunity to listen to Mr. K. G. Compton, Bell Telephone Laboratories, Inc., New York City, discuss "Corrosion of Metallic Protective Coatings". His talk was amply illustrated with slide pictures and led to a lively discussion. As an added feature, Mr. Compton showed pictures taken on his trips to India, Japan, and other foreign countries during the war. They were enjoyed by all.

Messrs. H. R. Stogner, Clem Hohner, and Charles Woolfolk were appointed to serve as a committee to study the A. E. S. Constitution and By-Laws.

William T. Weymouth,
Secretary-Treasurer.

SPRINGFIELD BRANCH

The meeting on September 22 began with a three-minute talk by Mr. Arthur Zavarella, member of this branch, on "Sulfoalkane Copper Solution". Librarian John Horrigan then introduced Mr. Ralph McCahan of E. I. du Pont de Nemours & Company who gave a very interesting talk on "Trouble Shooting Cyanide Plating Solution." A question period followed which pleased both the practical plater and the technical man.

Laurence R. Fountain,
Secretary-Treasurer.

TWIN CITY BRANCH

Thirty-eight members and guests attended the dinner meeting on October 6.

Membership Chairman Ray Krieger introduced the first woman member of the Branch, Miss Frances J. Sains of Lewis Metal Plating Company.

It was decided to continue to hold the dinner meetings at the Covered Wagon Cafe.

Librarian C. A. Bowman introduced Mr. Joseph Mazia of American Chemical Paint Company who spoke on "Electrolytic and Pickle Polishing". Mr. Mazia illustrated his talk with an actual demonstration and answered several questions from the members.

Bob Buckley,
Secretary-Treasurer.

ABSTRACTS

(*Continued from page 1366*)

was concerned with Type T.45, a manganese steel, and DTD.178A, a chromium-molybdenum steel.

The experimental work included studying methods of adapting electropolishing for use as a process in the machine shops. In one application the internal surfaces of a steel cylinder were required to be honed to a glass-like finish. Electropolishing was directed toward reducing production time.

The author closes with remarks on the measurement of surface finish along the lines of profilometer analysis.

For general discussion of the mechanism of electropolishing, reference is made to papers by S. Wernick*, P. Jacquet†, and Imboden and Sibley‡.

In comment on this paper, it can be added that there are conditions for producing mirror-like finishes on high carbon steels and on steels containing appreciable amounts of tungsten and molybdenum by electropolishing in sulfuric-phosphoric acid solutions. Surface smoothening measurements, which have been of interest to the abstractor, reveal that electropolishing an average thickness of 0.001 inch from a surface showing a profilometer measurement of 50 rms, reduces the roughness reading to about 25 rms, and removal of another 0.001 inch reduces the roughness further to about 12 rms. The smoothness can be brought to about 2 rms when clean steel is used.

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*J. Electrodep. Tech. Soc. **18,** 103–120 (1943).

†Comptes rendus **201,** 1473 (1935).

‡Trans. Electrochem. Soc. **82,** 227 (1942).

RECTIFIER "PACKAGES" PROVIDE NEW FLEXIBILITY AT HARTFORD CHROME CORPORATION

Addition of two "2000" units speeds handling of varied plating jobs

Continuing its program of adding dependable, easy-to-use rectifier equipment to meet expanding requirements for plating power, the Hartford Chrome Corporation has recently installed two new General Electric "2000" copper-oxide rectifiers and control equipment. These power "packages," consisting of a fan-ventilated rectifier and an operator's control, have proved invaluable in providing the flexibility needed for an ever-changing variety of work.

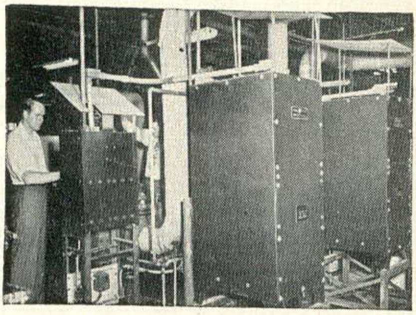
The rectifiers are installed away from working areas, free from injurious fumes. A handy, at-the-tank operator's control governs all operations, permitting instant changes in power input as they are required.

Each rectifier delivers to the plating tank 2000 amperes on one set of bus bars, or 1000 amperes on each of two sets of bus bars. It is also possible to connect the rectifiers in series, to deliver 4000 amperes. Future plans call for the addition of fully automatic motor-operated controls that will keep output voltages constant from "no load" to "full load" within ± 2 per cent of selected reading.

General Electric Equipment Selected on Basis of Past Performance

With the addition of these units, Hartford Chrome now has 12 General Electric rectifiers, with a total rating of 9000 amperes. Most of the equipment has been in operation for four to five years.

During this time, maintenance costs have averaged 25 to 35 per cent lower than those before General Electric rectifiers were installed. On the basis of upkeep, performance, and flexibility, to meet various needs of plating and anodizing, General Electric equipment has proved to be the most economical and efficient that this active plant has ever used.



View shows how rectifiers have been placed in open, nonworking area. Units are easily accessible for cleaning or repair, and are protected from dirt and vapor fumes.

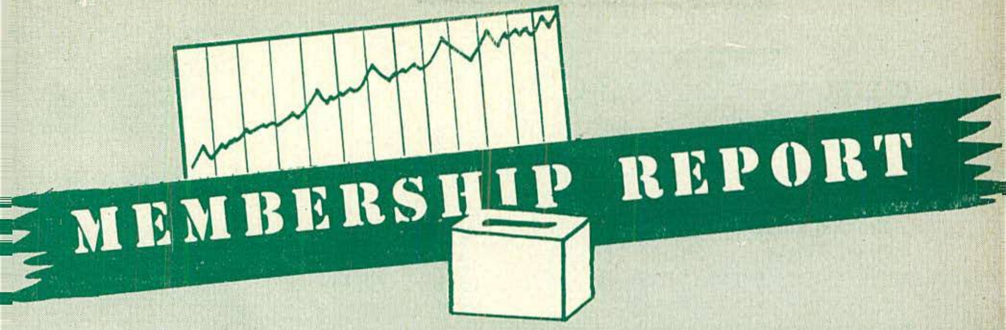
Economies For Your Plant

General Electric copper-oxide rectifiers and controls are readily available in many sizes and capacities, to solve plating or anodizing problems in your plant. They offer many advantages that go a long way in keeping production costs low.

Call on us for engineering assistance, too. We may be able to show you important operating economies, based on the use of efficient General Electric plating equipment.

For information, or for your copy of *General Electric Copper-oxide Rectifiers and Controls*, write to Section A75-1168, Appliance and Merchandise Department, General Electric Company, Bridgeport 2, Connecticut.

GENERAL ELECTRIC



MEMBERSHIP REPORT

ARTHUR W. LOGOZZO
Chairman, Membership Committee

ELECTIONS

BRIDGEPORT BRANCH: William A. Ross

DAYTON BRANCH: John K. Easton, Kermit E. Froebe, J. G. Walker

DETROIT BRANCH: L. A. Danse, William L. Herrman, A. O. Ihormahlen, R. C. Rogge, W. W. Shapiro, O. H. Tiedeman

JACKSON-LANSING BRANCH: Howard K. Brown, John O. Chandler, Harold C. Marsh, Ealum H. Spraker

LANCASTER BRANCH: Richard E. Field, Henry J. Schneider

MILWAUKEE BRANCH: Arthur J. Hocevar, Edwin S. Lev

NEW HAVEN BRANCH: Francis J. Antinovitz, Donald F. Kinckiner, Francis J. Malone, Francis J. Murphy

NEWARK BRANCH: Walter J. Ehrlinger, Ralph A. Heiss, Richard C. Henkel, Charles B. Little, Eugene Marchione, Herbert R. Pitts, George I. Reuter, John E. Trumbour, Daniel W. Woolley, Jr.

NEW YORK BRANCH: Seymour Berman, Angelo F. Congemi, James Dimen, Harry W. Goodall, Harvey S. Levine, Ernest Moll, Joseph Novitsky, Lester S. Wolf

PHILADELPHIA BRANCH: Richard Blumberg, William J. Johnson, Robert P. Stafford

PITTSBURGH BRANCH: John L. Collins, Howard A. Irvine, Harold E. Ketchum, Lawrence J. Kisner, Carl L. McHattie, H. W. Peters, Emil Polivka, Gus J. Schaffner, Jr., Norman Shorr, Pablo A. Sacerdote, R. A. Woofter, Richard J. Zaiden

PROVIDENCE-ATTLEBORO BRANCH: George Breault, John H. Broadbent, Jr., Robert F. Crook, George W. Muir, Benjamin J. Perkoski, Rocco Velletri

ST. JOSEPH VALLEY BRANCH: John C. Bayman

SAN FRANCISCO BRANCH: Emil M. Kachman, Nick P. Premenko

SOUTHEASTERN BRANCH: George W. Taylor

SYRACUSE BRANCH: Edward Noxon, James G. Stevens, Harry Watters

TOLEDO BRANCH: Hugh E. Bennes, Frank Criscio, Samuel Criscio, Paul Dressel, Wallace E. Friedel, Rolland M. Guides, Paul Mirabello, Joseph Rocco, Donald Whittenburg

TWIN CITY BRANCH: Sherman G. Jensen, F. L. Mickelson, F. J. Sains, P. Warner

REINSTATEMENTS

ROCHESTER BRANCH: Michael Pavone

SYRACUSE BRANCH: A. A. Gutekunst

TRANSFERS

John T. Donaldson from New Haven Branch to Bridgeport Branch; D. F. Mosher from Dayton Branch to Cleveland Branch; Robert D. Miller from Dayton Branch to Cincinnati Branch; D. T. Ewing from Detroit Branch to Jackson-Lansing Branch; R. L. Thebaud from Chicago Branch to St. Joseph Valley Branch (previously published from Chicago to Detroit Branch); Carl Cartlege from Southeastern Branch to Detroit Branch; Donald A. Hilliard from Waterbury Branch to Chicago Branch

SUSPENSIONS

CLEVELAND BRANCH: Paul V. Rebel, Stayton G. Todd

DETROIT BRANCH: A. B. Wilson

JACKSON-LANSING BRANCH: W. H. Bennett, C. H. Blacklidge, B. A. Fager, Bronson E. Howard, Joseph McCluskey, B. H. Wright

NEW YORK BRANCH: Oscar Harding, Joseph Linn, Nils P. Wikner

PROVIDENCE-ATTLEBORO BRANCH: Roger Amantea

ST. JOSEPH VALLEY BRANCH: Wayne Cone, Donald Cook, Donald First, L. Hofferbert

SOUTHEASTERN BRANCH: Charles M. McDonald, Durwood Smith

SPRINGFIELD BRANCH: A. W. Woods

SYRACUSE BRANCH: Dan Dissoway, Jack Harnett, Peter J. Vercillo

TORONTO BRANCH: Jack W. Miller

RESIGNATIONS

JACKSON-LANSING BRANCH: R. E. Quick, L. C. Surato, C. E. Topping, Eric Windfuhr

MILWAUKEE BRANCH: Frederic Barber, Joseph M. Palleck

NEW YORK BRANCH: Louis Holland

PITTSBURGH BRANCH: Richard Rimbach, Clarence W. Holmes

ST. JOSEPH VALLEY BRANCH: Harry Dietrich, Henry Welling

SAN FRANCISCO BRANCH: Carl W. Kuba, James F. Upchurch

TORONTO BRANCH: Stewart McLeod

TWIN CITY BRANCH: Joseph B. Bambenek

DEATHS

JACKSON-LANSING BRANCH: D. M. Bennett

ROCHESTER BRANCH: Frank E. Schwind

Results of Referendum Vote

The referendum vote on the amendments of the By-Laws to increase the dues by $2.00 per member per year has given the following results:

"*By-Laws Part I, Supreme Society. Articles VI, Duties of Branch Societies, Section 3, Amount of Per Capita Tax.* (a) Effective February 1, 1948 for new members and May 1, 1948 for members in good standing on December 31, 1947, a per capita tax of $4.70 per annum shall be contributed by each branch to defray the expenses of the Supreme Society."

For 58 *Against* 27

"*By-Laws Part II, Branch Societies. Article VI, Dues, Section 1, Minimum Dues.* (a) The minimum annual dues shall be $8.00 per year and may be paid quarterly, semi-annually or annually."

For 60 *Against* 30

A two-third vote is required for passage. Therefore, the amendments to the By-Laws Part I and Part II have both passed.

MEMBERSHIP REPORT

BRANCH	Membership May 1, 1947	New Members	Net Change in Membership	Per Cent Net Change
FIRST GROUP				
LOS ANGELES	198	22	+20	+10.1
BOSTON	160	17	+13½	+ 8.4
CHICAGO	410	32	+26	+ 6.3
BRIDGEPORT	147	11	+ 6	+ 4.1
PHILADELPHIA	218	18	+ 7½	+ 3.4
CLEVELAND	192	13	+ 5½	+ 2.9
GRAND RAPIDS	136	16	+ 2½	+ 1.8
WATERBURY	139	2	+ ½	+ 0.4
TORONTO	144	5	+ ½	+ 0.3
NEWARK	257	22	− 1	− 0.4
HARTFORD	141	1	− ½	− 0.4
NEW YORK	259	15	− 1½	− 0.6
DETROIT	423	30	−20	− 4.7
SECOND GROUP				
PITTSBURGH	126	22	+16½	+13.1
NEW HAVEN	114	9	+10½	+ 9.2
ROCHESTER	88	5	+ 6	+ 6.8
ST. LOUIS	96	5	+ 5	+ 5.2
SAN FRANCISCO	77	6	+ 3½	+ 4.5
TWIN CITY	89	5	+ 4	+ 4.5
BUFFALO	98	3	+ 2½	+ 2.5
MILWAUKEE	124	8	+ 1	+ 0.8
ST. JOSEPH VALLEY	88	7	+ ½	+ 0.7
PROV.-ATTLEBORO	126	15	......	......
BALTIMORE-WASH.	119	9	− 1	− 0.8
DAYTON	95	4	− 1	− 1.1
INDIANAPOLIS	103	16	−11½	−11.3
THIRD GROUP				
ADELAIDE	49	14	+13	+26.5
TOLEDO	55	13	+12	+21.8
SYDNEY	78	16	+12	+15.4
SPRINGFIELD	73	4	+ 2	+ 2.7
LANCASTER	38	4	+ 1	+ 2.6
SYRACUSE	73	3	+ 1½	+ 2.1
COLUMBUS	35	6	+ ½	+ 1.4
CINCINNATI	52	2	......	......
MELBOURNE	61	..	......	......
ROCKFORD	64	4	− 2	− 3.1
MONTREAL	60	1	− 2	− 3.3
SOUTHEASTERN	43	4	− 1½	− 3.5
JACKSON-LANSING	65	4	− 7½	−11.5
TOTAL A. E. S.	4,913	393	+126	+ 2.6

Membership, November 10, 1947....5,039

INDUSTRY NEWS

Job Shop Operations

According to the September issue of the *Monthly Bulletin of the Masters' Electro-Plating Association*, New York City, rate of operations in September shows the first increase in many months: 55 per cent against 48.5 per cent in August, 1947 and 80½ in September, 1946.

Jade Powder for Polishing Hard Materials

Suitable for polishing extremely hard materials, extra fine, fast, and very tough *Jade Powder* is intended to ease and speed mirror polishing of various hard metals, most jewel and mineral matter, and other materials less hard than the diamond. It is available in four grits: *No. 3* (2 microns average diameter of the particles), *No. 2* (5 microns), *No. 1* (8 microns), and *No. 0* (the coarsest, 12 microns), and may be obtained from *Linick Chemical Company*, Suite 1612, 29 E. Madison Street, Chicago 2, Ill.

Filter Equipment

Titeflex, Inc., 628 Frelinghuysen Avenue, Newark 5, N. J., has published a 4-page catalog *No. 120* which describes and depicts Titeflex industrial filter equipment for the plating industry and other industries where filtration is required. Photographs of three models of filters are shown and their features are concisely discussed.

Abrasive Belt Grinders

Four-page bulletin *No. GP-1*, offered by *Hill Acme Company*, 6457 Breakwater Avenue N. W., Cleveland 2, Ohio, describes and illustrates three types of endless abrasive belt grinding and polishing machines for processing flat surfaces. Photographs show the general appearance of the hydraulic type for sheet stock, pinch roll type for bar stock, and the coiler type for strip.

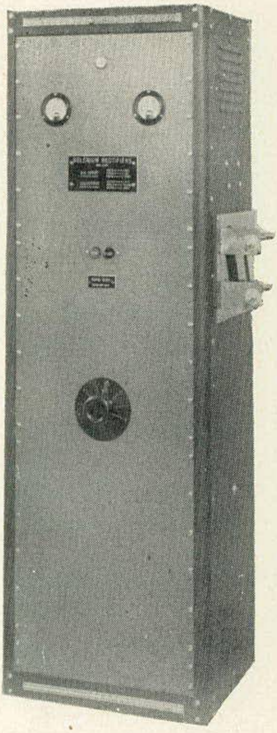
The Electric Products Company Establishes Three West Coast Offices

To better serve the West Coast, *Gordon J. Berry*, Vice-President of *The Electric Products Company*, 1725 Clarkstone Road, Cleveland 12, Ohio, announces the establishment of District Offices at Portland, San Francisco, and Los Angeles.

In charge of the Portland Office (342 Sherlock Building) is *Mr. William J. Cottrell*, a graduate Electrical Engineer, who has had extensive experience in the field.

The San Francisco Representative is *Mr. Donald T. Elliott* with offices at 921 Howard Street. Mr. Elliott holds a B.S. Degree in Electrical Engineering from the University of California, and is a member of Tau Beta Pi.

In Los Angeles, the office of The Electric Products Company at 1262 S. Boyle Avenue is under the direction of *Mr. H. D. Easterbrook*. With a 1910 B.S. degree in Electrical



Engineering from the University of Illinois, he joined Westinghouse Electric Corporation and remained with that company until 1940 when he became a manufacturer's agent.

Buffing and Polishing Machines

A 16-page catalog *B-10* illustrating heavy duty and extra heavy duty buffing and polishing machines covers sizes from ½ to 60 h.p. and the infinitely variable speed control with "*Speedial*". Write to *Standard Electrical Tool Company,* 2477 River Road, Cincinnati 4, Ohio, for your copy.

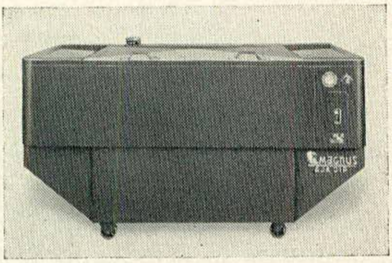
"pH Tables for Electroplaters"

R. P. Cargille, 118 Liberty Street, New York 6, N. Y., has issued a pamphlet, "*pH Tables for Electroplaters.*" This is a comprehensive tabulation of plating baths, listing the permissible *p*H range with the optimum *p*H for each bath. References to original articles are cited for each process, and information is given regarding how photocopies of these articles may be obtained.

The Tables are issued especially for use with the new *Cargille Set of pH Papers.*

Magnus Offers New Cleaning Equipment

The Equipment Division of the *Magnus Chemical Company, Inc.,* of Garwood, N. J., has recently re-designed and increased with new models its complete line of *Magnus Aja-Dip* (agitates and dips the work) *Cleaning Machine.*



Cleaning with the Magnus Aja-Dip Machines is fully automatic and thorough requiring labor only for loading and unloading. The operator is freed for other duties while the Aja-Dip does the cleaning.

Magnus Aja-Dip Cleaning Machines are available in 13 sizes and types from the Midget type handling a few pounds of work

to the Jumbo type handling 2,00 pounds at a time. They may be used with either hot or cold cleaning solutions. If heated, heat may be by steam, electricity, oil, gas or kerosene.

Complete information on the Magnus Aja-Dip Cleaning Machines is available by writing to the *Equipment Division, Department MR, Magnus Chemical Company, Inc.*, Garwood, N. J.

Michigan Abrasive Company Names New General Sales Manager

C. H. "Fid" Wills has been named General Sales Manager of the *Michigan Abrasive Company*, Detroit, Mich., *Max C. Jones*, Company President, announced recently.

Mr. Wills will have complete responsibility for the world-wide sales of Michigan Abrasive materials, which include sheets, rolls, discs and belts of all types and sizes. He comes to the Michigan Abrasive Company after ten years as Detroit-Toledo representative for another abrasive company

Air Filters

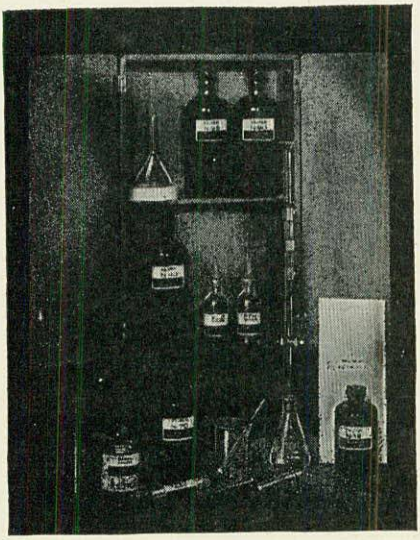
The application of replaceable type air filters for ventilating and air-conditioning systems is explained in an 8-page booklet, *No. 210* which may be had from *American Air Filter Company, Inc.*, 215 Central Avenue, Louisville 8, Ky. Descriptions and illustrations of each type filter are given along with instructions for maintenance and detailed engineering and installation data.

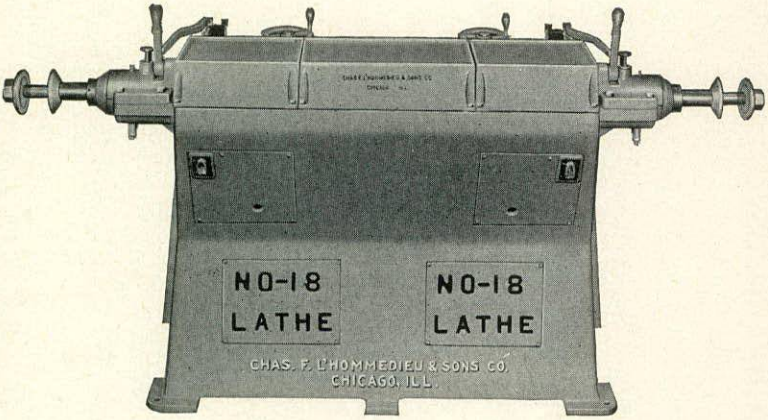
Eco Announces New Line of Gearless Pumps in Stainless Steel, Monel and Bronze

A new line of gearless pumps for general industrial use has been announced by *Eco Engineering Company*, 12 New York Avenue, Newark 1, N. J.

Based on the successful principle of *Eco Gearless Pumps*, which have been in use in the marine field for the past twelve years, the newly designed pumps include several special features and improvements which make them ideal for the handling of practically all types of liquids, acids, solvents, oils, etc. Chief among the improvements is the new double impeller design which gives a strong flow against pressure.

They are available in ¼ and ½ inch sizes, capacities from one to twelve gallons





NO-18
LATHE
NO-18
LATHE
CHAS. F. L'HOMMEDIEU & SONS CO.
CHICAGO, ILL.

per minute varying with pump speeds and pressures. Pumps can be used against pressures up to 50 pounds per square inch. Pumps can be run and will deliver at speeds from 200 to 3500 rpm.

Pickling Inhibitors

How certain acid inhibitors and neutralizing materials promote cost-savings and improved quality production in pickling iron and steel is the subject of a 6-page service report (*No. F-4880-R1*) of *Oakite Products, Inc.*, 157 Thames Street, New York 6, N. Y. A feature is a section containing graphs showing the action of the inhibitors in reducing metal loss. A comparison chart and table shows how they reduce acid consumption and extend life of solutions, and supplementary data include instructions for making up, controlling, and maintaining sulfuric acid and hydrochloric acid solutions.

Brightening and Protective Treatment for Zinc Plate

Features of a process for converting ordinary zinc plate into a brilliant, corrosion-resistant finish, are presented in a new 4-page bulletin on "*Unichrome Clear Dip*" by *United Chromium, Incorporated,* 51 E. 42nd Street, New York 17, N. Y. Advantages to product finishers in using zinc plate together with this chemical treatment are discussed, and the typical production cycle for the process is described.

New High Production Finish Announced by Zapon

A new synthetic production finish, named *Duranite-H,* capable of creating a coating of hitherto unknown hardness, flexibility, chip resistance, ease of handling, and economy, has been announced by the *Zapon Division* of the *Atlas Powder Company.*

The new Zapon coating, which is not formulated from any old line synthetics, is said to cure extremely full and lustrous and to have superior resistance to soap, humidity, salt spray, acids, and grease. Its heat resistance is claimed superior to any urea and melamine modified alkyd enamel.

It is generally applied by spraying and has a baking schedule of one-half hour at 420° F.

BURNT CORK *may be O.K. for the* END MAN

But *Irons* and *Steels* Deserve JETAL BLACK

. . . the best protective and blackening finish available

JETAL is a tough, speedy "blackface" for your irons and steels. It is no thin skin of burnt cork illusion.

JETAL goes on fast, but it stays on. **JETAL** is better because it does more and costs less.

JETAL is a black oxide coating that is easily and inexpensively applied by immersion in less than 5 minutes.

JETAL is tough, long lasting and adaptable.

JETAL may be resistance or spot welded, and soldered.

JETAL will not chip, peel, crack, crumble or dust off, even on bending or cutting.

JETAL forms a fine base for lacquer, enamel or japan.

JETAL resists wear and penetration better than any black on the market.

JETAL is black **BLACK,** deep and solid.

JETAL does not change metals dimensionally after application.

JETAL costs less and can be applied by immersion in bulk, baskets or barrels.

JETOIL 1A

JETOIL 1A effectively guards against rust. As a supplemental oil film after JETAL coating, it protects during assembly, inspection, storage or in service; rust is not apparent until after more than 50 hours salt spray testing.

⇦ OTHER ALROSE FINISHES ⇨

BLACK

Oxidine B — for blackening copper and brass.

Oxidine Z — for blackening zinc.

Bring your finishing problem to ALROSE for the best solution. Let ALROSE JETALIZE your sample product, or demonstrate the JETAL PROCESS in your plant.

WHITE

Bon White — an immersion tin finish for copper, brass or aluminum — exceptionally bright white — ideal soldering base.

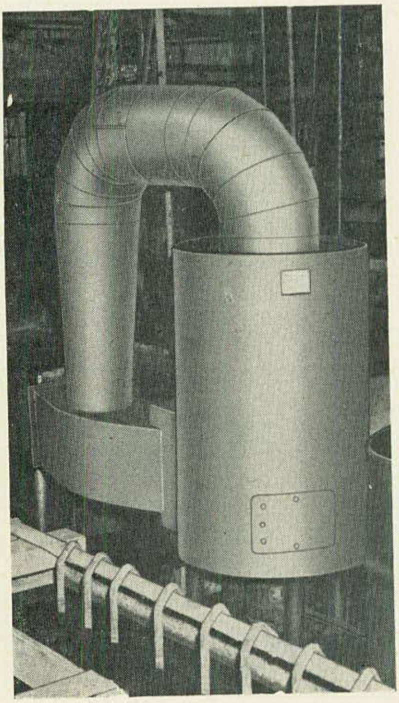
Wite Brass plates a tertiary alloy of copper, zinc and tin, giving brilliant, non-tarnishing, long-wearing surface over all base or precious metals.

ALROSE CHEMICAL COMPANY
Manufacturing and Research Chemists
PROVIDENCE, RHODE ISLAND • WILLIAMS 3000

Both Zapon plants in Stamford, Conn., and in North Chicago, Ill., are already meeting manufacturing needs for dishwashing machines, sinks, stoves, hardware, and other articles.

New Fume Separator

A new *fume separator* which cleans contaminated air without the loss of room heat has been developed and is being placed on the market by the *Industrial Electroplating Company, Inc.*, 219 W. Vermont Street, Indianapolis, Ind.

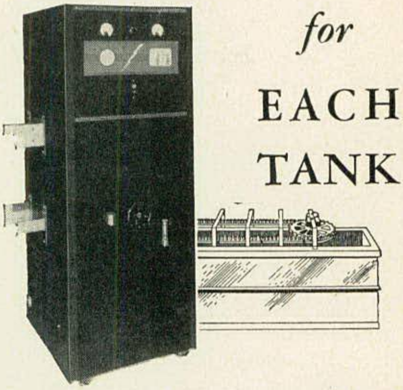


The newly introduced fume control unit draws contaminated air off electroplating tanks, cleans it by water absorption and centrifugal separation, and returns pure air to the shop without wasting heat. The unit utilizes a minimum of ductwork, making installation and maintenance inexpensive.

The fume separator is the invention of two brothers, *Carl* and *William Niehaus*.

Two models are available, having capacities of 1500 cfm and 3000 cfm respectively. Each model is avilable with separating chambers of plain carbon steel or stainless steel.

A RECTIFIER *for* EACH TANK



Better Work . . . Lower Costs

Greater flexibility in handling varying jobs from tank to tank is assured by the installation of an R-A Selenium Rectifier for each tank. The finest voltage settings for the most difficult job in each tank can be set without overall loss of power. The complete installation is economical too.

Richardson-Allen Selenium Rectifiers are a great advancement in current conversion, engineered and built for long hard service. All units are tested at 25% continuous overload before leaving the factory.

Standard units available for immediate delivery. Write us today for data bulletins and the name of your nearest dealer. He will be glad to give you comparative cost figures on installation and operation.

Consider These Advantages:

1. Continuously variable stepless voltage control sealed in oil.
2. No lag in starting.
3. Adaptable for remote control.
4. Constant efficiency with varying loads.
5. No standby losses when not under load.
6. Internal forced cooling.
7. Thermostatic protection.
8. Units operate in room temperature up to 105° F.
9. Switches and pilot light on both basic and remote control units.

Rectification for Every Application

RICHARDSON-ALLEN CORP.
15 WEST 20th STREET, NEW YORK 11, N. Y.
Sales Engineers Located in Principal Cities

Manufacturers of the most complete line of standard Selenium Rectifiers

RICHARDSON-ALLEN
Selenium Rectifiers

Finishing Equipment

"*Despatch Finishing Equipment,*" a 16-page bulletin, contains many articles and illustrations of ovens, dryers, air heaters, spray booths, and other finishing equipment. Write to *Despatch Oven Company,* Minneapolis 54, Minn., for *Bulletin 51.*

Aero Method in Ventilating

Advantages gained by applying aerodynamic principles to ventilator design are fully described in a new brochure of *G. C. Breidert Company,* 3129 San Fernando Road, Los Angeles 41, Calif. This illustrated booklet tells of the results in wind tunnel tests and in actual use on all types of installations. Free copies will be sent to those interested in this method of ventilation.

New Filter Book

The application of replaceable type air filters for ventilating and air-conditioning systems is explained in an eight-page booklet issued by *American Air Filter Company, Inc.,* 215 Central Avenue, Louisville 8, Ky. Descriptions and illustrations of each type filter are given, along with instructions for maintenance and detailed engineering and installation data.

New Finishing Booklet

The publication of a new booklet of interest to all engaged in the manufacture or sale of magnesium products has been announced. Covering various phases of magnesium, the booklet is titled, "*Machining and Finishing Magnesium Castings.*" It is said to be completely factual and contains no advertising matter. Copies can be secured free upon request by writing to *Superior Magnesium Castings,* 140 Banker Street, Brooklyn 22, N. Y.

Centerless Grinder-Polisher

A new addition to the line of grinding and polishing equipment is now in production. Known as the *OD-1* cylinder grinder-polisher for rods, bars and tubes, it is a centerless machine using coated abrasive belts for grinding and polishing. It will remove up to 0.005 inch per pass on ferrous metals and up to 0.010 inch on nonferrous. Work supports will handle one-half inch bars up to 18 feet long and one inch bars up to 8 feet long. The endless abrasive belt is 4 inches wide, 60 inches long, and may be operated dry or wet with coolant. Wet operation is recommended as it gives better finish, does not discolor work from heat and gives a higher production with longer belt life. Two methods of feeding are employed; through feed, and end feed. The through feed is generally used and is accomplished by swinging the regulating wheel on its horizontal axis from zero to 12°. The rate of feed can be varied from zero to 18 feet per minute. Although just announced, the machine is not new, in that the first model was exhibited at the National Metal Congress in Cleveland in 1944. This machine has given more than three years of satisfactory service. It is now in production and on about four weeks' delivery basis. For further information write *Hammond Machinery Builders, Inc.*, 1608 Douglas Avenue, Kalamazoo 54, Mich.

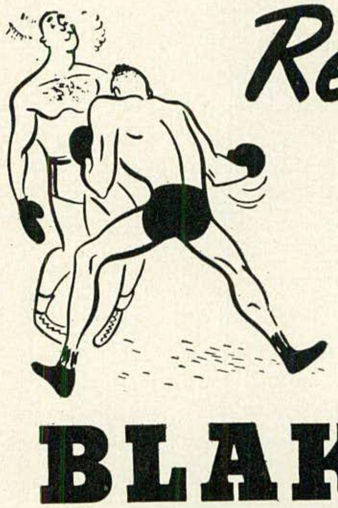
Foxboro Manufactures Dew Point Recorders

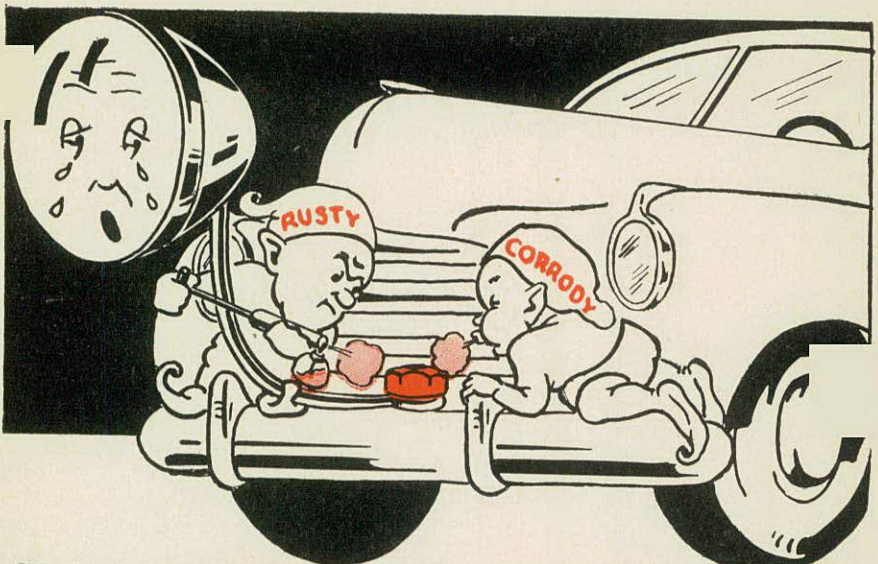
Dew Point Recorders and *Recording Controllers*, said to be the first simple, continuous dew point measuring instruments available for industrial use, are the newest additions to the line of industrial instruments offered by *The Foxboro Company*, Foxboro, Mass. They are the result of several years of research and development and extensive field-test installations. A considerable number are already in use.

Dew Point Recorders and Controllers are illustrated and fully described in *Bulletin 407*, of which copies will be sent on request.

Modernization Plan Now Completed by Zapon

To meet post-war demands for greater production of industrial finishes, the *Zapon Division* of the *Atlas Powder Company*, with plants at North Chicago, Ill., and Stamford, Conn., has completed a vast




RUSTY
CORRODY

modernization plan, according to *E. H. Bucy*, General Manager of the Division.

New equipment has been added, rebuilding has been done, and key floor plans rearranged so that all tend toward greater productivity with heightened laboratory control. Mr. Bucy pointed out that in order to accomplish this, concrete mezzanines were added so that solvents and resins could be piped directly from storage tanks to production areas by gravity flow.

Additional modern and up-to-the-minute facilities for pigment grinding were also installed, so that now the plant is equipped with late model number 3 roll-mills, steel-ball mills, and newest type Berylite mill.

MacDermid Opens West Coast Office

MacDermid, Incorporated of Waterbury, Conn., recently announced the opening of the Los Angeles, Calif.. office and warehouse.

Mr. G. Stuart Krentel, former Chicago Manager, has been appointed West Coast Manager and can be reached at 1011 S. Los Angeles Street, Los Angeles 15, Calif. Telephone: Prospect 7754. A complete stock of *MacDermid cleaning compounds and MacDermid Bright Copper* supplies are carried in warehouse stock in Los Angeles for the convenience of West Coast clients.

Bulletin of Interest to Platers

La Motte Chemical Products Company, Towson, Md., offers a *Service Bulletin G-2-46* which describes briefly this company's control equipment for plating solutions. A variety of *p*H equipment is featured.

Dual Metal Wire Has Diverse Applications

An entirely new type of electroplated and drawn wire, "*Fernicklon*", manufactured by *Kenmore Metals Corporation*, 80 Broad Street, New York 4, N. Y., can be bent, swaged, hammered, or twisted without flaking. It has a wide range of manufacturing applications in such products as household utensils, tinsel wire, and numerous other items where finish and durability are important considerations. It eliminates the need for plating goods after fabrication.

Initial production includes steel wire with nickel, copper wire with nickel or silver, and die polish or satin finishes are available. Because of its surface perfection and absolute bond between its constituents, it can be subjected to severe climatic conditions when an anti-corrosive coating metal is used. It can also be welded to form a product without destroying the coating at the point of weld.

Data on Valves

A new bulletin published by *Hanna Engineering Works*, 1765 Elston Avenue, Chicago 22, Ill., gives specifications and operating data on all Hanna valves. The line consists of foot-operated and hand-operated valves for air and hydraulic lines, and speed control valves for use with air and hydraulic cylinders.

Latrobe Electric Steel Receives 1947 Achievement Award

Latrobe Electric Steel Company, Latrobe, Pa., has received the *1947 Special Achievement Award* made yearly by Materials and Methods magazine "for achievement in developing new engineering materials which result in higher production and lower cost of manufactured goods", the Company announces.

The award was made in recognition of Latrobe Electric Steel Company's development of *Desegatized* brand steels, in which segregation—a major handicap in tool steels—has been virtually eliminated.

Reports show superior toughness in Desegatized brand steels, ranging from 20 per cent to 200 per cent when compared in impact testing with non-dispersed segregate steels of similar grades. Statistics furnished by users of dispersed segregate tools and dies showed outstanding improvements in performance life.

Dr. Vinal Receives Navy Commendation

Dr. George W. Vinal, battery expert and chief of the *Electrochemistry Section of the National Bureau of Standards*, has been awarded the Certificate of Commendation by the Bureau of Ships of the Navy Department.

The Certificate of Commendation was granted for outstanding service to the United States Navy during World War II in development of new types of batteries and for Dr. Vinal's work with the Joint Army Navy Battery Advisory Committee of which he was secretary.

Dr. Vinal is internationally recognized for his research in the field of electrochemistry, particularly for his work in the development and perfection of the silver voltameter and the standard cell, which serve as standards for the international ampere and volt.

Quality Control

An 8-page booklet on quality control covering two subjects: "*Charts Help Diagnose Quality Progress*" and "*How To Analyze Production Rejects*" is offered by *North American Philips Company, Inc.*, 100 E. 42nd Street, New York 17, N. Y. Illustrated with drawings and tables, the subject matter is clearly presented and should be of interest to those wishing to improve quality control techniques.

Gwyer Joins H-VW-M

The *Hanson-Van Winkle-Munning Company*, Matawan, N. J., announces the appointment of *Eugene G. Gwyer* to its engineering staff. He will be located in Matawan, working in the Engineering Sales Department.

New Metal Finish

The *Mitchell-Bradford Chemical Company*, 2446 Main Street, Stratford P. O., Bridgeport, Conn., announces a new "*Finish No. 146*" which can be used as a clear corrosion-protective finish on plain or black-oxidized steel or as a tenacious undercoating on steel, aluminum, zinc base alloys, copper alloys, and magnesium for subsequent paint, lacquer, or enamel coatings.

The coating can be applied by dipping, spraying or brushing, and can be baked or air dried. It is available both clear and tinted.

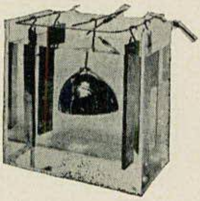
It is also formulated in a water-displacing type, designated as "*Finish No. 146-W*".

For further information write to the manufacturer.

Adjustable Anode Rods for Still Tank Equipment

The *Hanson-Van Winkle-Munning Company*, Matawan, N. J., announces the development of a new *adjustable anode rod* for use in alkaline solutions and also chromium plating baths which will permit more uniform plating of irregularly shaped parts in still plating tanks.

The new device consists of brackets welded or bolted to the tank wall to which steel

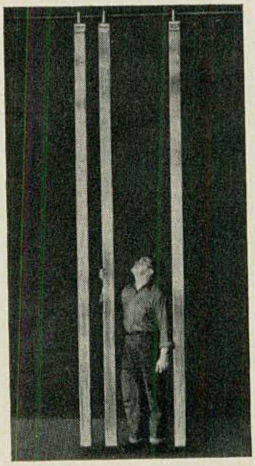


plates or arms, insulated on either side with Phenol fiber, are pivotally attached. At the outer end of these arms are swivel fittings on which are mounted annular clamps containing insulators which surround and support the anode rod. These insulators, formed in two halves, are easily installed and clamped in place around the rods, while the ball anode holders or straight elliptic anodes, as the case may be, are supported by the rod. This rod is of sturdy, simple design, capable of supporting several hundred pounds of anode material which can be moved to any desired position with a minimum of effort.

Electric current is supplied by means of a flexible cable attached to one end of the rod, while an insulated handle is provided at the other end to permit adjustment as needed.

Lead Anodes

Special Divco 71-Point Lead Anodes, 12 feet long with special high conductivity hooks, for chromium plating long sections of tubing and pipe, are made by *Division Lead Company*, 836 W. Kinzie Street, Chicago 22, Ill. In addition to the high efficiency and great throwing power of the 71-Point Design, it is claimed that the deep-ribbed construction minimizes buckling and warping. Special and Conforming Anodes, as well as standard anodes, are manufactured using the 71-Point Design.



New Zapon One Coat Hammer Line Now Complete

An improved one coat hammer line has recently been completed by the *Zapon Division* of the *Atlas Powder Company,* and is now ready for merchandising, according to *Don Metz,* assistant general sales manager of the firm's Stamford office.

This new product finish, available in bright, cheery colors, can be had in quantities from five gallons to unlimited amounts, ready to spray.

According to Mr. Metz, this material can be sprayed with a minimum one coat pass because of the excellent coverage it affords. By the addition of special thinners the hammer effect may be cut back by the customer himself to produce a smooth surfaced, high gloss finish. Through the use of careful masking and drying it can be used to attain a two-tone effect.

Hinderliter Tool Company Acquires "Nail-it" Manufacturing Rights

The *Hinderliter Tool Company Division* of the *H. K. Porter Company, Inc.,* Tulsa, Okla., announces its acquisition of all manufacturing rights for *"Nail-It" Pipe Couplings, Swivel Joints,* and *Pump Suction Couplings.*

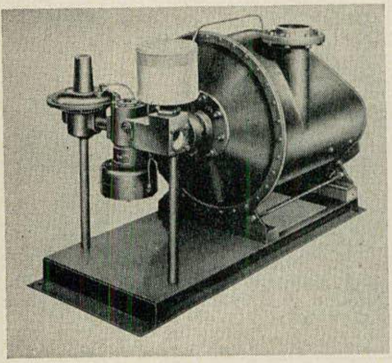
Manufacture of these products will begin immediately at the Hinderliter's Tulsa works under the new trade name of *"Nail-It-Kwik".*

This new coupling principle and sealing method is very unique and is said to be the fastest type of coupling yet devised. The halves of the unit are coupled by driving common nails into mating grooves in the male and female ends and are uncoupled by merely pulling the nails. Two or more nails are used on each coupling to form a removable steel shear ring of greater strength than a regular line pipe joint.

Oil-and-wear resistant synthetic *"O"-Ring Gaskets* form pressure tight seals in "Nail-It-Kwik" products. No mechanically applied compression is necessary to effect a seal, and scarring or abrasion of the sealing surfaces will not cause leakage, as the "O"-Rings seal between, not on, mating surfaces.

New Gas-Air Mixer Permits Visible Operation

A completely new *Gas-Air Mixer* that permits such features as visible operation has been perfected for the industrial gas field by a Chicago gas engineering concern. The Mixer is designed to pre-mix any commercial gas—natural, manufactured, or liquid petroleum gases—with air in any desired proportion and in any desired quantity within the capacity of the unit. This mixture is then delivered to the burners under constant pressure.



With this Mixer, accurately controlled combustion mixtures are assured for all types of heating processes. Extremely close temperature control, high heat input, practically unlimited turn-down range, high burner pressure and any desired flame characteristic are stated to be features of the new mixer.

At present the several models provide mixture capacities from 3,000 to 18,000 cubic feet per hour, with larger sizes planned for future production. Discharge pressures range from 28 to 32 ounces, with uniform 3500 rpm for all five models.

Those interested can obtain the illustrated *Bulletin No. 825* by writing the manufacturer, *Gas Appliance Service, Incorpoporated*, 1211 Webster Avenue, Chicago 14, Ill.

Plastic Flooring

A color folder about *Plastile*, the new laminated vinyl floor tile, made from tough *Tygon* plastic, which has served industry for years, may be had by writing to *U. S. Stoneware Company*, Akron 9, Ohio.

A. E. S. DIRECTORY

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P. O. Box 168, Jenkintown, Pa.

ADELAIDE AUSTRALIA. Acting Secretary, G. N. Dixon, G. P. O. Box 428D, Adelaide, Australia.

BALTIMORE-WASHINGTON meets first Tuesday of each month in October, December, February and April at the National Bureau of Standards, Washington, D C, and in November, January, March and May at American Hammered Piston Ring Company, Baltimore, Md. Secretary, Grace Riddell, Chemistry Division, National Bureau of Standards, Washington 25, D C.

BOSTON meets first Thursday of each month in Hotel Statler, Boston, Mass. Secretary, Dr. George P. Swift, 53 Galen Street, Watertown 72, Mass.

BRIDGEPORT meets first and third Friday of each month in Barnum Hotel. Secretary-Treasurer, Joseph G. Sterling, 134 Colony Street, Bridgeport 8, Conn.

BUFFALO meets second Friday of each month in Markeen Hotel, Buffalo, N. Y. Secretary, H. A. Fodeman, 534 W. Ferry Street, Buffalo 13, N. Y.

CHICAGO meets second Friday of each month at 8 P. M., in Atlantic Hotel. Sec'y-Treas., J. M. Andrus, 3701 Ravenswood Ave., Chicago 13, Ill.

CINCINNATI meets on fourth Wednesday of each month at 8 P. M., in Engineering Society Headquarters, McMillan Street and Woodburn Avenue, Cincinnati Ohio. Secretary-Treasurer, L. M. Rasmussen, 3228 Brotherton Rd., Cincinnati 9, Ohio.

CLEVELAND meets first Friday of each month in Cleveland Hotel, at 8 P. M. Secretary-Treasurer, George B. Svenson, 2059 Hamilton Avenue, Cleveland 14, Ohio.

COLUMBUS meets first Friday of each month in Battelle Memorial Institute Auditorium, 505 King Avenue, Columbus 1, Ohio, at 8 P. M. Sec'y-Treas., Bernard Agruss, 505 King Ave., Columbus 1, Ohio

DAYTON meets second Friday of each month in Engineers' Club, Dayton, Ohio. Secretary Treasurer, Elmar W. Rehme, 505 Commercial Bldg., Dayton 1, Ohio.

DETROIT meets first Friday of each month in Hotel Statler. Secretary-Treasurer, F. L. Clifton, 16536 Inverness, Detroit 21, Mich.

GRAND RAPIDS meets second Friday of each month, 7:30 P. M., in Rowe Hotel. Secretary, Jacob M. Hage, 1327 Jefferson Ave., S. E. Grand Rapids, Mich.

HARTFORD meets third Monday of each month in Hotel Bond, Hartford, Conn. Secretary, A. J. Dankevich, 63 Massachussetts Ave., New Britain, Conn.

INDIANAPOLIS meets first Wednesday of each month at Fox Steak House, 1207 Washington Street. Secretary-Treasurer, James J. Monagle, 1464 N. Colorado Ave., Indianapolis, 1, Ind.

JACKSON-LANSING meets second Tuesday of each month at Home Dairy Company in Lansing. Secretary-Treasurer, U. J. Forsyth, 1816 Ada Street, Lansing 10, Mich.

LANCASTER meets second Friday of each month, at 8 P. M., in Thaddeus Stevens Industrial School, Lancaster, Pa. Secretary-Treasurer, H. Clay Brubaker, 881 Manor Street, Lancaster, Pa.

LOS ANGELES meets second Monday of each month at 6:30 P. M. Secretary, Dean D. Williams, 2728 W. 42nd Street, Los Angeles, Calif. 2728 W. 42nd St., Los Angeles 43, Calif.

MELBOURNE, AUSTRALIA. Secretary, L. A. Francis, G. P. O. Box 4502.

MILWAUKEE meets first Friday of each month in Red Arrow Club, 774 N. Broadway. Secretary-Treasurer, James Durnford, 64 Eastman St., Oconomowoc, Wisc.

MONTREAL meets first Tuesday of each month in Mount Royal Hotel, Montreal, Quebec, Canada. Secretary-Treasurer, William L. Glover, 754 Second Avenue, Verdun 19, Quebec, Canada.

NEWARK meets first and third Friday of each month in Hotel Robert Treat, Newark, N. J., at 8 P. M. Secretary-Treasurer, George Wagner, 1130 S. Long Avenue, Hillside, N. J.

NEW HAVEN meets second Tuesday of each month alternating between Sterling Chemistry Laboratory, Yale University, and Hotel Taft. Secretary-Treasurer, B. J. Gaffney, 40 Filbert Street, Spring Glen, Hamden 14, Conn.

NEW YORK meets second and fourth Fridays of each month, in Hotel Pennsylvania, 7th Avenue and 33rd Street, New York, N. Y. Secretary-Treasurer, Franklyn MacStoker, 25 Princeton Street, Garden City, L. I. N. Y.

PHILADELPHIA meets fourth Friday of each month in Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Streets. Secretary, Paul Mentzer, Sr., 7242 Bingham Street, Philadelphia 11, Pa.

PITTSBURGH meets third Thursday of each month at 6:30 P. M., in Keystone Hotel. Secretary-Treasurer, R. A. Dimon, 210 Semple Street, Pittsburgh 13, Pa.

PROVIDENCE-ATTLEBORO meets the third Monday of each month in Providence-Biltmore Hotel. Secretary-Treasurer, Edward A. Parker, 15 Vale Ave., Cranston 10, R. I.

ROCHESTER meets third Friday of each month in Hotel Seneca. Secretary, James Weaver, 884 Whitelock Road, Rochester 9, N. Y.

ROCKFORD meets second Monday of each month in Faust Hotel. Secretary, Vern T. Wissen, Forest Hills Rd., Rockford, Ill.

SAN FRANCISCO meets second Thursday of each month, alternating between El Jardin Restaurant, 22 California St., San Francisco, and El Curtola Restaurant, 510 17th St., Oakland. Secretary-Treasurer, Jack Hite, c/o A. A. Plating Works, 1420 Harrison St., San Francisco 3, Calif.

SPRINGFIELD meets fourth Monday of each month in Hotel Charles. Secretary-Treasurer, L. R. Fountain, 15 Cortland Street, Springfield, Mass.

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ST. LOUIS meets second Wednesday of each month in York Hotel, 6th and Market Streets. Secretary-Treasurer, E. R. Hunleth, 4415 Michigan Avenue, St. Louis, Mo.

SOUTHEASTERN meets second Thursday of each month in Robert Fulton Hotel, 114 Lucky Street N. W., Atlanta, Ga. Secretary, William T. Weymouth, 173 Clay St. S. E., Atlanta, Ga.

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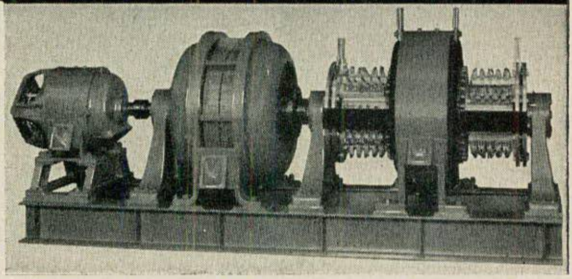
SYRACUSE meets second Friday of each month in Bowne Hall, Syracuse University. Secretary, M. P. Boland, Jr. 211 Rich Street, Syracuse 4, N. Y.

TOLEDO meets first Thursday of each month in the office of Vic Miner Company, 329 20th Street, Toledo, Ohio. Secretary, Gaston Bergeman, 703 Pine Street, Fremont, Ohio.

TORONTO meets second Friday of each month in Royal York Hotel. Secretary, Leonard W. Wray, 105 Ronan Avenue, Toronto 12, Ont., Canada.

TWIN CITY meets first Monday of each month, October through June, in Covered Wagon Cafe, Lodge Room, 114 S. 4th Street, Minneapolis. Secretary-Treasurer, Robert L. Buckley, 318 Builders Exchange, Minneapolis 2, Minn.

WATERBURY meets second Friday of the month in Elton Hotel. Secretary-Treasurer, Spencer L. Henn, P. O. Box Dr. B, Cheshire, Conn.



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When you are ready to write your order, remember Harshaw Single Nickel Salts are far superior to the old large crystals, yet cost no more.

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THE HARSHAW CHEMICAL CO.
1945 East 97th Street, Cleveland 6, Ohio
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LETTER FROM THE EDITOR

December 1, 1947

Dear Reader--

This is literally and actually the last page of THE MONTHLY REVIEW. As was announced in last month's editorial columns, the January 1948 issue of this publication will bear the title of PLATING. PLATING will be larger in page size than THE MONTHLY REVIEW and will be distinctively styled with a new format. It will be easier to read, too, because it will have larger type in the text matter.

The decision to enlarge the size of the publication was made several years ago, but the war, with its corresponding paper shortage, prevented carrying out the plan. January 1948 offered the first practical opportunity for this change.

Active planning for the new publication has been under way for over a year. There have been an untold number of staff conferences. Outside authorities in the plating and publishing fields have contributed generously with good advice. All who have seen the advance "lay-out" of the new format have spoken enthusiastically of it.

We feel confident that our readers will receive the "new look" of PLATING with enthusiasm. The same high quality, factual editorial content that has characterized THE REVIEW will form the basis of PLATING. Interesting and useful new features will be added in coming months. And in the same manner that an electroplater adds a pleasing appearance to a finished product, we are attempting to make our "editorial package" as attractive as possible.

Sincerely,

Gustaf Soderberg

Ge to the Heart . . .

of your Plating Problems

With MAC DERMID INCORPORATED superior Compounds. It's important! It's a must! Our chemists devote painstaking efforts in formulating *specific compounds* for *specific plating problems.* Our quarter-century's specialized development is your assurance that *you can Get to the Heart of your Plating Problems* with MAC DERMID INCORPORATED superior Compounds.

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A compound that is truly different . . . cleans diecastings and brass *in one solution.* Use either direct or reverse current or a combination of both. Cleans without oxidizing or tarnishing base metal. Assures a bright, *uniform, adherent deposit.*

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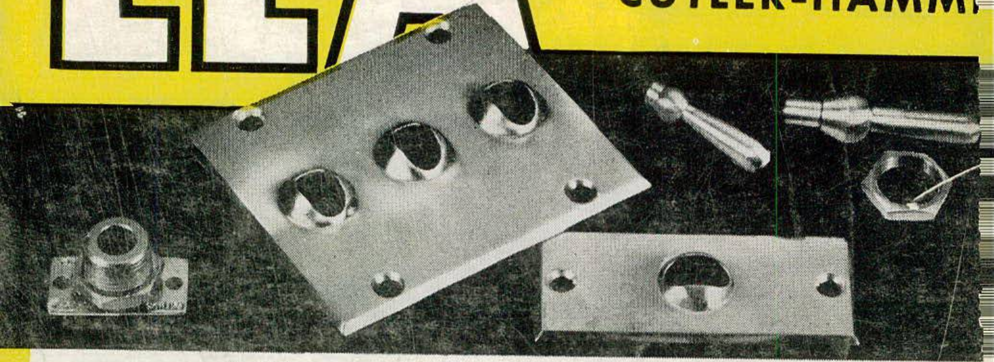

Switch Levers, Threaded Bushing, Hexagon Face Nuts, Single Switch Plate, 3-Gang Switch Plate

Many thousands of these small parts are made each week by Cutler-Hammer, Inc., Pioneer Electrical Motor Control and Appliance Switch Manufacturers of Milwaukee. They're parts used in assembling the utility type toggle switch, one of a broad line of electrical controls made by this well-known company. Each part is satin finished with Grade C LEA Compound by a method which LEA Technicians helped to work out. It's a finish that implies "quality", a characteristic which all Cutler-Hammer products have.

Perhaps we can help you, too, in your burring, buffing or polishing problems. LEA Compositions used with a LEA Method may help you cut costs and improve the quality of your finishing.

THE LEA MANUFACTURING CO.

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