THE ELECTRODEPOSITION OF COBALT.

By Byron Carr.

The following tests were carried out more than two years ago to check the results of Dr. H. T. Kalmus referred to in a paper by Mr. W. S. Burrows to the American Electro-Platers' Association.

The cobalt bath used was that numbered XIII*b* which is made up as follows :—

Five ozs. boric acid are dissolved in $5\frac{1}{2}$ pints of boiling water. In this $2\frac{1}{2}$ ozs. of sodium chloride are dissolved, and then $4\frac{1}{2}$ lbs. of crystalline cobalt sulphate. The bath was used hot at 34° C. in these experiments, though temperatures as high as 100° F. have been recommended when working with very high current density reaching 780 amps. per. square foot with stationary electrodes, and even 1000 amps. per square foot where the solution is agitated. The electrodes on this work were stationary.

To obtain satisfactory results the cathode must be perfectly clean and smooth, all imperfections being still clearly seen after the deposition of the cobalt. The bath should be clear and excess of boric acid, if undissolved, should be filtered off. One set of experiments made with a muddy bath, possibly due to an impure sample of the cobalt salt, gave deposits which, though appearing at first sight sound and adherent, left the basis plate at once on the slightest bending. "Quicking" in a solution of mercuric cyanide was not found to be appreciably better or worse.

The deposit, which is very hard and will take on a very fine polish, is remarkably resistant to atmospheric corrosion. One polished deposit which has been lying in a chemical laboratory for over two years is still practically perfect.

It will be noted from Table I. that only the thinner deposits are adherent, and that as they thicken they begin to blister and peel off spontaneously or do so under very small bending stresses. The cobalt foil made in this way, *i.e.* by allowing a thick non-adherent deposit to peel off, may have commercial value.

This is quite in accord with the results of Dr. Kalmus, who recommends a current density of about 150 amps. per square foot, and a period of immersion of two minutes.

Some experiments were carried out to determine the influence of the composition and surface of the basis plate. The results are collected in Table II.

The deposits polish well, and though thin, have no tendency to expose the basis metal beneath. It will also be noted that in comparison, for instance, with nickel plating, these cobalt deposits are obtained very quickly indeed.

TABLE I.

DEPOSITS IN BUFFED SURFACE OF BRASS.

No.	Current density, amps. per sq. ft.	Time, mins.	Deposit.
1	22·8	6	Fine, smooth, bright.
1*a*	22·8	16	Deposit curled off and left cathode quite clean.
2	49·2	5	Smooth, adherent deposit.
3	49·2	6	Do. do. do.
4	72	2	Do. do. do.
5	72	3	Do. do. do.
6	72	5½	Deposit peeled off cathode.
7*b*	72	5	Deposit distinctly blistered and beginning to peel off.

TABLE II.

Basis Plate.	Current density, amps. per sq ft.	Time, mins.	Deposit.
Nickel . . .	48	3½	Deposit peeled off.
Polished brass . .	48	2½	Very good adherent deposit.
Do. do. . .	81·6	2½	Polishes well. The lower C.D. gave slightly better deposit.
Brass plate coppered in alkaline copper bath	50·5	3	Good deposit.
	81·0	6	Blistered: not adherent.
Copper plate as received	110	5	Good but rough deposit.
Copper plate buffed .	71·5	2	Very smooth deposit.