by Field, where 100 per cent would be perfect. This is similar to the throwing power of cyanide copper or silver baths.

Properties of the Deposit

The function of an electrodeposited noble metal coating is to provide the underlying base metal with a corrosion resistant surface. Pore-free deposits of minimum thicknesses are therefore required, and it is recognised that the smoother the surface the thinner the deposit needed to give complete protection.

Two methods were used to test for porosity in the deposits on polished copper panels, a gas exposure method, and an electrographic technique using cadmium sulphide papers. The electrographic test was carried out by placing the panel on a piece of moistened filter paper impregnated with cadmium sulphide, applying a pressure of 200 lb/in^2 and passing a current of 25 mA/in^2 for 30 seconds, the panel being the anode. Any pores appeared as black spots on the cadmium sulphide paper, and by this method the deposits were found to be pore-free down to a thickness of 0.00002 inch.

The gas test, which is more severe, consisted of exposing the panels to a humid atmosphere containing 1 per cent SO_2 for 24 hours, washing them, drying with filter papers, and exposing to moist 1 per cent H_2S for four hours. Deposits of 0.0002 inch were completely pore-free by this test and those of 0.00015 inch were substantially pore-free.

The stress in the deposit was found, by spiral contractometer, to be 25,000 to 30,000 lb/in^2. Semi-bright deposits from tetrammino-palladous nitrate baths have a stress of 30,000 to 35,000 lb/in^2, and fully bright deposits 70,000 lb/in^2. The hardness of the deposited palladium is 300 to 400 V.P.N.

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High-Stability Fixed Resistors

NOBLE METAL FILMS IN GLASS TUBES

A new type of noble metal film resistor, now in quantity production by Siemens and Halske, is described by Werner Kugelstadt (*Siemens Zeitschrift*, 1965, **39**, (2), 145–149).

The resistors comprise a thin 80:20 gold-platinum diffusion alloy film applied to the inside of high insulating toughened glass tubes, and helically grooved to obtain the required values.

The alloy film is deposited and fired on to the substrate by a ceramic decorating technique using a solution containing organic compounds of gold and platinum, and small amounts of other metals to promote adhesion, which are controlled to provide a film sufficiently soft to be mechanically grooved without stressing. The thickness of the film is controlled within the range 0.01 to 5.0μ in which maximum stability is obtained with a specific resistance of about 40$\mu\Omega$ cm.

Use of the relatively soft elastic noble metal alloy film of stable structure is claimed to eliminate corrosion and irreversible changes in resistance during temperature cycling due to differences in thermal expansion between the film and the substrate. It is also claimed to provide a positive temperature coefficient of resistance of about 300×10^{-6} per °C constant between -70 and $+200$°C, and to give exceptionally low noise in operation.

The resistors have a maximum continuous operating temperature of 165°C. Two main types are available, for power loadings of 0.5 and 1.0 watt with values between 1 Ω and 240 KΩ, and 2 Ω and 510 KΩ respectively. The author discusses in detail factors governing the performance of metal film resistors, and gives data on electrical properties, dimensions, and conformity of the resistors to German and United States specifications.