Abstracts of Technical Articles by Bell System Authors

A Sampling Inspection Plan for Continuous Production.[1] H. F. DODGE. This paper presents a plan of sampling inspection for a product consisting of individual units (parts, sub-assemblies, finished articles, etc.) manufactured in quantity by an essentially continuous process.

The plan, applicable only to characteristics subject to non-destructive inspection on a Go-NoGo basis, is intended primarily for use in process inspection of parts or final inspection of finished articles within a manufacturing plant, where it is desired to have assurance that the percentage of defective units in accepted product will be held down to some prescribed low figure. It differs from others which have been published in that it presumes a *continuous flow* of *consecutive articles* or *consecutive lots* of articles offered to the inspector for acceptance in the order of their production. It is accordingly of particular interest for products manufactured by conveyor or other straight line continuous processes.

In operation, the plan provides a corrective inspection, serving as a partial screen for defective units. Normally, a chosen percentage or fraction f of the units are inspected, but when a defective unit is disclosed by the inspection it is required that an additional number of units be inspected, the additional number depending on how many more defective units are found. The result of such inspections is to remove some of the defective units, and the poorer the quality submitted to the inspector, as measured in terms of per cent defective, the greater will be the corrective or screening effect. The object of the plan is the same as that incorporated in some of the sampling tables already published, namely, to establish a limiting value of "average outgoing quality" expressed in per cent defective which will not be exceeded no matter what quality is submitted to the inspector. This limiting value of per cent defective is termed the "average outgoing quality limit (AOQL)."

The theoretical solution treats the case of inspecting a continuous flow of individual units and is based on the distribution of *random-order* spacing of defective units in product whose quality is statistically controlled. Part III of the paper extends the application of the method to a continuous flow of individual lots or sub-lots of articles.

Stability in High-Frequency Oscillators.[2] R. A. HEISING. This paper discusses frequency stability with change in plate voltage of high-frequency

[1] *The Annals of Mathematical Statistics*, September 1943.
[2] *Proc. I.R.E.*, November 1943.

oscillators of around 100 megacycles and shows both theoretically and experimentally that the highest stability found by many is only the result of fortuitous circuit adjustment that may readily lead to the desired result in this frequency range. It is shown that the factor next in importance in producing frequency stability is a low ratio of inductance to capacitance in the frequency-determining circuit. It is also shown that a high Q contributes little directly to stability. A high Q is necessary with low L/C ratios to get oscillations but an improvement in Q alone may give poorer stability. To get the fullest measure of stability with low L/C and high Q calls for slight adjustments in the circuit and possibly the provision of loose coupling to the frequency-determining circuit.

Modern Spectrochemical Analysis.[3] EDWIN K. JAYCOX. The spectrograph, originally developed by the physicist, has become a most useful tool in the hands of the analytical chemist. Today few large analytical laboratories are without one. The instrument, with its attendant accessories, provides a rapid method for analyzing metals, alloys, minerals, ores, liquids, and gases, particularly for their metallic constituents and in some cases for their anions. Both emission and absorption spectra are important to the analyst. Important applications of the spectrograph to the analytical problems of research and industrial organizations are discussed.

The spectrograph did not come into general use as an analytical tool until the early 1920's, although Kirchhof and Bunsen saw the practicability of the method in 1860, when they published their paper entitled, "Chemical Analysis by Means of Spectral Observations." During the intervening years only a few enthusiasts like Lockyer, Roberts, Hartley, Leonard, Pollack, and de Gramont, kept the art alive. In spite of their persistent efforts to influence chemists to use spectrographic methods, they were quite generally ridiculed and the value of the method was recognized by only a few workers.

In 1922, Meggers, Kiess, and Stimson published their paper "Practical Spectrographic Analysis" and modern spectrochemical analysis was born. Under the stimulus of this paper and the backing of a high caliber scientific organization like the Bureau of Standards, the use of the spectrograph as an analytical tool increased rapidly. This is evidenced from the *Index to the Literature on Spectrochemical Analysis* by Meggers and Scribner. In 1920, for example, only five papers were published concerning spectrochemical analysis, four of which were by de Gramont; whereas in 1930, 33 papers were published and in 1939, 170 papers, indicating an increasing interest in and use of spectrochemical analysis in industrial and research organizations.

[3] *Jour. Applied Physics,* December 1943.

Determination of Small Amounts of Arsenic, Antimony, and Tin in Lead and Lead Alloys.[4] C. L. LUKE. A new method for the determination of small amounts of arsenic, antimony, and tin in lead and lead alloys consists of separation of the three metals from the lead by a double co-precipitation with manganese dioxide, reduction of arsenic and antimony to the trivalent state, separation of the arsenic by distillation as chloride, titration of the arsenic and antimony separately by the method of Gyory, and reduction of tin with lead and titration with standard iodine solution.

Determination of Total Sulfur in Rubber.[5] C. L. LUKE. A new volumetric method has been developed for the determination of sulfate sulfur. The sulfate is reduced to sulfide by treatment with hydriodic acid and the hydrogen sulfide is distilled off and titrated iodometrically. The new method has been applied to the determination of total sulfur in natural and synthetic rubber.

Machine Screws. Fastening Strengths in Various Materials.[6] A. C. MILLARD. Although standard machine screws in the numbered sizes have been widely used as fastenings for many years, very little has been published concerning their strength of fastening in various metals and non-metals. Numerous articles have appeared regarding the strength of bolts and machine screws for $\frac{1}{4}$ in. and larger sizes, but very little, if any, published information is available on the strength of machine-screw fastenings in the numbered sizes.

The need for machine-screw fastening-strength information has increased recently due to the use of more compact designs and the shortage of materials. The use of substitute materials has accentuated the lack of machine-fastening-strength information in making fastenings in such materials, as well as in the more commonly used materials. Frequently, it is desirable to know the load-carrying capacity of screw fastenings of various diameters, as well as the length of thread engagement in the weaker materials needed to develop either the full strength of the screw, or the strength of fastening required of the assembly. The purpose of this paper is to make available to designers the results of fastening-strength tests of machine-screw fastenings in a number of materials, which were carried out by the author at the Bell Telephone Laboratories, Inc. The work is by no means complete but is hoped that the data offered will prove to be of some use in its present form.

[4] *Indus. & Engg. Chemistry*, October 1943.
[5] *Indus. & Engg. Chemistry*, September 1943.
[6] *Mech. Engg.* October 1943.