

tablishing of relations, not in the cataloguing of facts.

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QUOTATIONS

THE EARNING POWER OF RESEARCH

A FEW years ago the X-ray tube was an erratic apparatus not in any very general use. The research laboratory of the General Electric Company realized that there was a possibility of utilizing pure electronic emission from a hot filament to produce controllable X-rays in a perfect vacuum. They conducted extensive research upon such devices as then existed, and as a result the tungsten target took the place of platinum in the standard gas tube of that day. Research had also to be applied before the laboratory learned positively that available electrons already existed and that there was a possibility of controlling them, as, for example, focusing them on a target. The research has been continued, until today practically all the X-ray tubes of the country are made by the company in accordance with the discoveries of the man whose name the tubes bear. The Coolidge tube is also used abroad almost to the exclusion of other types. These remarkable results have been achieved through very careful, accurate, and often discouraging studies of electric phenomena in high vacua, with very pure materials. The perfection of the tube is the nucleus of an annual business, including accessories and generating apparatus used in X-ray work, of from five to ten million dollars a year. The benefit cannot be measured wholly in monetary return, for everyone is familiar with the humanitarian benefits.

Our oldest industries have been the most reluctant in establishing research laboratories. But the experience of a leader may guide the entire industry. Some years ago the Ward Baking Company established a fellowship at the Mellon Institute. The research soon brought results and the application of a more balanced yeast nutrient to the dough gave better fermentation and better bread. It was discovered that the baker can grow yeast in the dough and control fermentation wastes. This

conservation amounts to 2 per cent of the flour, 15 per cent of the sugar, and sufficient yeast to make the total saving 45 cents net per barrel of flour used. It is estimated that this process saves American, Canadian, and British bakers not less than \$40,000 per day, without detriment to the quality of the bread.

In 1915 a control laboratory was installed with one chemist. Today there are a variety of control laboratories with twenty-five technical workers. A chemist has frequently saved two months' salary for his employer with a report on samples from a single carload of butter. The control which has been established as a result of research upon the raw materials makes possible uniformity in the finished product. Time, temperature, and other factors which influence fermentation have been established, and since no two carloads of flour are alike the data are vital in determining how fermentation must be varied to secure uniformity. The study of enzymes, proteins, colloids, yeasts, bacteria, and nutrient value is pointing the way to still better bread, higher nutritive values, economy in production, and the elevation of the entire industry. It is no wonder that during these days of industrial depression this pioneer in research as applied to baking has increased the number of its scientific workers. Results continue to justify the increase.—*The Journal of Industrial and Engineering Chemistry*.

SCIENTIFIC BOOKS

A Monograph of the Existing Crinoids. Volume

1. The Comatulids. Part 2. By AUSTIN HOBART CLARK, Curator, Division of Echinoderms, United States National Museum. Bulletin 82. Washington, 1921. 4 to Pp. xxvi + 795; with 949 text-figures and 57 plates.

The first part of Clark's monograph appeared in 1915.¹ The present brochure, fully twice the size of its predecessor, constitutes the concluding part of the general introduction to The Comatulids. The systematic description of the group will follow. The major part of this work has already been completed and much of it has appeared in a series of monographs and

¹ Reviewed in SCIENCE, N. S., Vol. XLII, No. 1080, p. 342, Sept. 10, 1915, by Frank Springer.