Belgium; 4) new "head-end" techniques; and 5) the status of fluoride volatility processing in Belgium and France.

The record of the panel question-and-answer is of particular interest. Typical questions were: Is the processing of natural uranium fuels necessary? Will improved technology reduce costs? Are one-cycle processes practical? What is the role of volatility? What is the best fuel-processing method for breeder reactors? What is the effect of the size of a processing plant on costs? What is the importance of the transportation problem? Of course, opinions were divergent. It was apparent, for example, that transportation problems have not been well defined, partly because of conflicting (or lack of) regulations in various countries.

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About the Reviewer: Raymond E. Blanco is Chief of the Chemical Development Section of the Chemical Technology Division, Oak Ridge National Laboratory. Since 1944 he has been active in the fields of nuclear fuel processing, waste treatment and disposal, and radiochemical and isotopic separations techniques. He presented a survey paper, "Recent Developments in Solvent Extraction with Tributyl Phosphate," at the Belgium Symposium in 1963 and also papers on fuel processing at the Belgium Symposium in 1957 and at the Geneva Conference in 1958. He received a B.S. degree in Chemistry from North Dakota State University in 1941 and has done graduate work at Brooklyn Polytechnic Institute.

Handbook of Applied Instrumentation. Editor-in-Chief: Douglas M. Considine; Associate Editor: S. D. Ross. McGraw-Hill Book Company (July 1964). Approximately 1000 pages. $32.50.

This book is a problem. In the first place, it is a problem to review and, in the second place, it is a problem, at least for this reviewer, to justify its existence. The difficulty of reviewing a handbook of over 1000 pages probably does not need explanation but, of course, my doubts about the very existence of such a beautifully produced handbook does require some further commentary.

According to the publisher's description, the *Handbook of Applied Instrumentation* is a comprehensive work presenting 'how to' information on determining instrumentation needs; selecting specific measurement and control systems; designing instruments for minimum installation and maintenance costs; and engineering instruments into diverse and numerous systems. The handbook is said to cover virtually all the major industries and fields, and in this I concur. One can find words about control of jelly and jam-making and in the same volume read about nuclear reactor instrumentation; all this in a thousand page or so, representing the work of at least 70 men of good will and impressive technical background. But the crucial question is: Does the book do what it is supposed to do?—Does it provide 'how to' information? Well, let's see.

Take the section on aerospace vehicle instrumentation (every self-respecting book has to have some space flavor these days). We find the major sub-section entitled "Satellite and Space-Vehicle Instrumentation." It is five pages long. Of the five pages, at least half is occupied by impressive looking but quite uninformative line drawings of such things as the instrument case of a sun sensor taken from a particular manufacturer's catalog. Under the heading "Sun Sensors," we look for 'how to' information. What we find in total is the following: "Sun sensors are used in determining the direction to the sun and to provide the signals necessary to point either the vehicle or a seeker toward the sun. The sensor shown in Fig. 63 can sense over a hemisphere, and by itself it contains no moving parts." This is the end of the information on sun sensors.

Nor could one really expect it to be otherwise. In a day of almost bewildering technological variety, a book five times as thick as this one could not really provide the 'how to' information so heavily stressed as its purpose. One can go on prowling through the volume and find many examples of the general sort just given. For instance, there is a very pretty outline drawing of the control panel of a research-type reactor, including the operator's chair. Then there are quite complicated-looking relay circuits illustrating a section on dimensional measurement and control, but I doubt that anyone really concerned with the problem of how to "design instruments for minimum installation and maintenance costs" or "engineering instruments into diverse and numerous systems" would get much help from the eleven pages in this book on the subject. In fact, the section concludes with a very good piece of advice "maximum control over quality and cost in. . . the gaging equipment results from the systems approach in which the gage maker is responsible for designing, building, calibrating, installing, servicing, and repairing the gaging equipment." This statement, it seems to me, applies to many, many thousands of instrumental applications discussed. The level is too general or obsolescent for anyone who really knows the subject he is interested in, and too specific for the people who have to worry about general management decisions involving instrumentation. It seems to me that the specialists have to go to the specialist treatises and the generalists would be far better off working from lists and tabular material of much less imposing dimensions than this volume (and, incidentally, not costing anywhere near $32.50).

One can, in an attempt to moderate this harsh indictment, point out that the handbook does provide leads to manufacturers and also contains a considerable number of references, but this is not what the handbook claims as its objective and, furthermore, judging at least by the references in the section on radioisotope instrumentation, there will be grave dangers in using the referenced articles uncritically. Thus, while it seemed a bit flattering to find one's own neutron-activation method for measuring the thickness of silver plating referenced in this volume, the reference is to work published in 1958, and not even this reviewer would use the method now to measure silver thickness. The world has moved a long way since then.

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The Theory of Branching Processes. By Theodore E. Harris. Springer-Verlag, Berlin; Prentice Hall Inc., Englewood Cliffs, N. J. (1963). 230 pp. $9.00.

A branching process may be thought of as a mathematical representation of the development of a population whose members reproduce and die, independently, subject to laws of chance. In the theory of a branching process we must take into account the *probability* for any possible development of the population and not just the development of an expected value. The development of a neutron population in a zero-power multiplying assembly can evidently be described as a branching process (other examples arise in cosmic-ray showers and biological populations). Although for most neutron multiplication problems one is content to study the expected value of the population which may be, for example, a solution of the time-dependent Boltzmann equation, nevertheless for any consideration of fluctuations and departure from expected values some form of branching theory must be used. The most important mathematical techniques for treating such problems are succinctly described in the present volume.

The first analysis of a branching process was made by Galton and Watson about ninety years ago in considering the extinction of surnames. The theory has seen extensive growth in the last twenty years, and, while many of the results are now standard fare in modern texts on stochastic theory and Markov processes, the Harris book is the most systematic and thorough summary of branching processes now available. The many references to recent Russian work are of particular interest.

The simple Galton-Watson branching process, in which objects of one kind (e.g. sons or neutrons) are considered a generation at a time, is the subject of the first chapter. Principal results are the extinction probability and the asymptotic behavior of the population after a large number of generations. Asymptotic results for subcritical, critical and supercritical populations are described. In succeeding chapters, these basic results are extended to 1) objects with a finite number of types (for example, neutrons and delayed neutron precursors) considered a generation at a time, 2) objects whose type must be characterized by continuous parameters (for example, velocity and position for neutrons), 3) objects considered as a function of continuous time rather than generation number, and 4) objects whose reproductive probabilities depend on their ages after birth.

In a long chapter, application is made to cosmic-ray showers, while a shorter chapter treats neutron multiplication. Emphasis is here placed on an integral equation for the moment-generating functional of the collision density. While much recent work on stochastic theory of neutron populations is not referred to, it can be mostly seen to fit easily into the context of subjects discussed by Dr. Harris.

The level of mathematical sophistication required of the reader will be found moderately high by most reactor physicists. A working knowledge of elementary probability theory (including such subjects as conditional probabilities, generating functions, and forward Kolmogorov equations) is required throughout. Some knowledge of measure-