The theory of mathematical machines. By F. J. Murray. New York, Columbia University Press, 1947. 8+116 pp. $3.00.

There is a fairly extensive but widely scattered literature on computing instruments of various types, ranging from simple devices such as slide rules to such highly complex ones as the ENIAC. The present interest in all these types of computers makes Professor Murray's book especially apropos. He has written on a level which should make the book of equal interest to the applied mathematician and to the engineer. Due, unfortunately, to the secrecy restrictions of wartime the author was not, at the time he wrote this book, able to mention all the new developments in the field of digital computers, particularly the electronic ones. Subsequent editions will undoubtedly contain additional chapters describing the new instruments and indicating the present trends in the field.

The first part deals with the field of digital machines—subject to the hiatus mentioned above. It gives a careful discussion of how coincidence noting devices, adders and multipliers can be realized by means of mechanical elements such as gears as well as by electromechanical devices such as relays. Thus the reader is given a picture of how the familiar types of desk multipliers and related devices function in principle, without having to follow intricate engineering details. The chapter concludes with a brief discussion of the principles underlying the operation of the familiar punch card machines.

After this brief but reasonably complete discussion of the field of digital computers prior to the war the author turns his attention in Part II to so-called measurement machines. These are devices in which numerical quantities are represented by the magnitudes of physical quantities such as rotations, displacements, voltages, and so on. They are, in contradistinction to digital instruments, usually special purpose in character. Perhaps the most widely known and general machine in this class is the differential analyzer. They are almost invariably remarkably ingenious and represent quite interesting attempts to use known physical or chemical principles to solve mathematical problems. One particularly interesting machine in this category is the one which solves Laplace's equation in a given region subject to boundary conditions by shaping a container with non-conducting walls to be the given region. The container is then filled with an electrolytic solution and the boundary conditions are satisfied approximately by placing conductors on the boundaries. The electric potential function then satisfies the equation subject to the boundary conditions and is measured at any point in the solution by means of a probe.