SESSION ON

HISTORICAL DEVELOPMENT

Presiding:

F. M. Dawson
Dean, College of Engineering, and
Director, Institute of Hydraulic Research
State University of Iowa

Historical Development of Experimental Hydraulics . C. E. Bardsley
Experimental and Practical Engineering Hydraulics of the Late 18th Century . J. J. Doland
(Discussion) The Results of a Model Study of the Cameron-Rutledge Mill . W. J. Putnam
Hydraulic Model Testing in the Spotlight . P. W. Thompson
HISTORICAL DEVELOPMENT OF EXPERIMENTAL HYDRAULICS

by

C. E. Bardsley, Professor of Hydraulics
Oklahoma Agricultural and Mechanical College
Stillwater, Oklahoma

Research in the authorities on the sources of the history of experimental hydraulics prompts the writer to divide the subject chronologically into four periods: (1) the period of antiquity dating from the earliest traditions to 1000 B.C., (2) the Roman period from about 312 B.C. to the Fall of Rome in 476 A.D., (3) the Renaissance period beginning about 1452 and ending before 1764, and (4) the period of Experimental Investigation from 1764 up to the present. It will be the purpose of this paper to enumerate man's accomplishments in knowledge and application of hydraulics in each of these periods. The paper is concluded by suggesting that we have entered into the period of Fundamental Concepts, and a prediction or hope for future development is expressed.

Period of Antiquity (Creation - 1000 B.C.)

In this period we have accounts of the utilization of rivers and canals for navigation, irrigation, water power and water supply. Many wells and reservoirs were constructed for water supply. Crude current wheels were used for irrigation and for industrial purposes. The water clock was used by astronomers for telling the time of star transits and the seasons of the year.

The Roman Period (312 B.C. - 476 A.D.)

During this period of less than a thousand years, history wit-

1 This is an abstract of the paper read at the Iowa Hydraulics Conference. The paper read was an abstract of a forty-page bulletin on this subject. The bulletin was distributed at the meeting. Additional copies of Historical Resume of the Development of the Science of Hydraulics by the writer, Publication No. 39, Engineering Experiment Station, Oklahoma A & M College, Stillwater, Oklahoma, can be obtained by writing for same.
nesses certain advances in hydraulic science, viz.: construction of a world trade canal, building of aqueducts, reservoirs, city water distribution systems, utilization of the inverted siphon, the arch, establishment of the laws of buoyancy, invention of the chain and bucket pump, and mention that public thought was directed toward the regulation of rivers.

The Renaissance Period (1452 - 1764 A. D.)

In the Renaissance Period, we have the canal building era which was made possible through the invention of the chambered lock and mitre sill gate. A sound mathematical theory for hydraulics was founded especially for orifices, hydrostatic pressures, short tubes, flow in rivers, and the statement of the equations of continuity and conservation of energy appeared. The Pitot Tube was invented, the constant \( g \) for gravity was established, and by the end of the period all the necessary knowledge was available to complete the formula \( V = \sqrt{2gh} \). The calculus was invented fifty years before the end of the period. The period established the fact that hydraulics was an experimental science which became the keynote of the period that was to follow.

The Period of Experimental Investigation (1764 A. D. to Present)

Modern hydraulic science is based almost entirely upon experiment; its periods of development coincide directly with periods of increased activity in the sphere of physical investigations. It was not until the beginning of the nineteenth century that enough experimental data had been assimilated to permit the foretelling of future progress, and another hundred years had to pass before the results marking the achievement of this progress were to be obtained. The twentieth century brought with it a revival of untold importance to the science, for at this time the first modern hydraulic laboratories made an appearance.

The Period of Empiricism to a Period of Fundamental Concepts (Present to ............)

The writer fully believes that hydraulic science is entering the period of fundamental concepts. During the past two centuries hy-
draulic design and phenomena have been empiricised or solved by trial and error methods tempered by the judgment of experience. Now mathematical analysis and the laboratory are supplying the researcher with the fundamental laws and compatible coefficients. It appears that in the near future that this science will have advanced sufficiently in practical fundamental concepts to be designated by the broader caption "Experimental Fluid Mechanics."