

## William Ephraim Heal, Indiana Pioneer Mathematician

WILL E. EDINGTON, DePauw University

Serious research study in mathematics in the United States did not really begin until after the founding of Johns Hopkins University in 1876, and the first non-honorary Master's degree in mathematics in Indiana appears to have been given to Joseph Swain, at Indiana University, in 1885. There were very few professional mathematicians in Indiana before 1890, and such as were here were born in other states than Indiana. Several resident Indiana mathematicians published research before 1900, among them Henry Turner Eddy, Clarence Abiathar Waldo, Arthur Stafford Hathaway, and Robert Judson Aley, but the first native born Indianan to publish research was, so far as I have been able to find, William Ephraim Heal, a native of Grant County, whose first paper appeared in the *Annals of Mathematics* in 1886.

William Ephraim Heal was born May 17, 1856, in Grant County, and his first ten years were spent on a farm. His family then moved to Delaware County but returned to Grant County in 1878. In that same year he was married to Miss Nancy E. Parrill, daughter of a farmer, William Parrill, who lived near New Cumberland. Heal by then had completed his formal education in the public schools and the county Normal School. In August, 1880, he moved to Marion, the Grant County-seat, and began clerking in a grocery store. A little later he became a deputy in the Clerk's office and held this position for two and a half years, and then accepted a position in the George N. Winchell store as bookkeeper. A year later he took a position in a Marion bank, and in 1885 he became deputy county treasurer. He was elected County Treasurer of Grant County in 1892, taking office August 12, 1893, and serving for the next two years. During this period he was active in civic affairs in Marion, and was one of the signers of the Articles of Incorporation of the Y.M.C.A., organized in Marion, May 19, 1891.

In 1902 Heal was asked by a group of men in Marion who were financially interested in the Coffeyville, Kansas, Glass Factory, to make an audit of the company's books. He stayed in Coffeyville until 1908 and then took up independent auditing, mostly municipal books, in various parts of the country. In 1910 he entered the Government service in Washington, D. C., doing efficiency accounting and later becoming a Computer in the Bureau of Plant Industry. He later was with the U. S. Coast and Geodetic Survey and remained there until his sudden death by heart attack on October 9, 1925, at the age of sixty-nine. Such are the principal details of the professional life of this pioneer outstanding Indiana mathematician.

From the study of his educational training and his professional life it is evident that none of it was particularly conducive to his mathematical development. In a brief biographical sketch which appeared, together with a photograph of him, in a Souvenir Magazine Section, issued in 1892 by the *Daily and Weekly Leader*, of Marion, *Marvelous Marion*, the Queen City of the Gas Belt, 1893, occurs the statement: He secured his education

in the "common and normal schools of the county and hence had superior advantages, but he early manifested a great liking for mathematics and astronomy, and it is in the former of these especially, that he shows his peculiar abilities. He took up and naturally and easily mastered the problems of Mathematical Astronomy, on to Analytical Geometry and the higher plane curves." That he possessed considerable innate mathematical power and ability is readily recognized when one realizes that he published at a time when America had only the American Journal of Mathematics, founded in 1878, and the Annals of Mathematics, founded in 1884, as vehicles for the publication of mathematical articles. His earliest publication was a problem and solution in the Annals of Mathematics, Vol. 2, Feb., 1886. In August, 1886, in this same volume appeared his first paper, so far as I can find, entitled "Expression of the Coefficients of Sturm's Functions as Determinants." He continued to propose problems and send in solutions to the Annals for several years. His second paper, "Some Properties of Repetends," appeared in Vol. 3 of the Annals, August, 1887, and in Vol. 4, April, 1888, he published "On Certain Singularities of the Hessians of the Cubic and the Quartic." In Vol. 5, October, 1889, pp. 33-41, appeared "The Bitangents of the Cubic," and in this same volume, pp. 109-110, is published a personal letter written to Heal by Professor Arthur Cayley, of Cambridge, England, in which Cayley, in reply to letter written by Heal to Cayley, recognizes the value of Heal's results and offers suggestions that will reduce his solutions to form found in Salmon's Higher Plane Curves. This was followed by the publication in the Annals, Vol. 6, Oct., 1891, pp. 64-68, of what is probably Heal's outstanding contribution during this period, a paper on "The Bitangential of the Quintic." This paper appeared in several leading scientific journals, among them The Proceedings of the London Mathematical Society.

That Heal enjoyed a certain national reputation is made evident by the fact that he was elected to membership in The New York Mathematical Society, in April, 1891, he being one of the first four mathematicians in Indiana elected at that time, the others being Henry T. Eddy, President of the Rose Polytechnic Institute, Clarence A. Waldo, at that time Professor of Mathematics at DePauw, and Joseph Swain, Professor of Mathematics at Indiana University. Swain went to Stanford with David Starr Jordan in the Fall of 1891 and returned to Indiana University in 1893 to become its president. Five other Indiana mathematicians were elected to the Society later in the year 1891, Robert J. Aley, Rufus L. Green, Arthur S. Hathaway, Moses Stevens and Alexander Knisely. The New York Mathematical Society was organized in November, 1888, at Columbia University, first as a local club, and did not become really national in its membership scope until 1891. It became the American Mathematical Society in 1894. In May of 1892 Heal was elected a member of the London Mathematical Society.

The American Mathematical Monthly was founded by Benjamin Finkel in 1894 and Heal published several papers in it shortly after its appearance: "Quadrature of the Circle," Vol. 3, p. 41; "Some Divisibility Tests," Vol. 4, p. 171; "Expression of Riemann's P Function as a Definite

Integral," Vol. 7, p. 155. Following this last publication, Heal moved to Kansas and I have not found that he published anything more in mathematics until in 1917 and 1918 when he discussed the demonstration of a geometrical theorem in the Monthly. Also when he went to Kansas it appears that he allowed his membership in the American Mathematical Society to lapse.

Mr. Heal became a member of the Mathematical Association of America in 1917 shortly after its organization in 1916, and he renewed his membership in the American Mathematical Society in 1919. He attended the Maryland-Virginia-District of Columbia Section meetings of the Association in May, 1921, December, 1921, May, 1922, May, 1924, and December, 1924, and he gave a paper on "Fermat's Last Theorem," at the May, 1921, meeting. But I do not find any reference to his further publication on anything in mathematics.

Following the receipt of the notice of Mr. Heal's death in 1925, W. D. Cairns, Secretary of The Mathematical Association of America, wrote to Mr. Heal's son: "I am very sorry indeed to hear of the death of your father. I recall how courteous he was at the Washington meeting last December when he made it a point to hunt us up at our hotel as officers of the Association and greet us before the meeting began."

Some years after Mr. Heal's death his mathematical library of some 155 volumes was given, in 1931, to the Tulsa, Oklahoma, Public Library, where it was arranged in the Technical Department and is known as "The Heal Mathematical Collection." It is a representative collection of volumes of Heal's time in the fields of advanced geometry, number theory, and the Philosophy of Mathematics.

From the preceding study it is evident that William Ephraim Heal was the first resident native born Hoosier to attain national distinction as a mathematician. That he possessed unusual mathematical talent, as compared with his fellow American contemporaries, cannot be denied. One can but wonder what he would have been able to accomplish in mathematics had he been privileged to study abroad and to develop his talent to its fullest.