By the time this volume comes from the press, the firm will have nearly completed an elaborate investigation of the properties and economics of nickel steel for railway bridges. This investigation will probably determine whether the large bridges of the future will be of the cantilever or the suspension type.

Although Dr. Waddell has originated many new features of bridge design which are of commercial value, only a few have been patented, the great majority being freely given to the profession. In 1893 he patented an "A" truss bridge which has been extensively and satisfactorily used for railway bridges. It possesses great rigidity and is much more economical than the plate girder for spans of about one hundred feet.

In 1894 he was granted a very broad patent on the principal features of the Halsted Street Lift Bridge, and in 1898 he obtained a patent on an automatic jetty for improving tidal ways. The jetties are provided on the harbor side with a continuous door, hinged at the top, which will open readily and permit the tide to flow into the harbor freely, but which will close automatically and force the outgoing tide to flow through a narrow channel which it will deepen by erosion.

In 1898 a patent was granted to Messrs. Waddell and Hedrick on a suspension bridge stiffened by cables in the form of an inverted catenary placed below the floor instead of the usual stiffening truss. A bridge of this type has lately been constructed in British Columbia.

In 1903 the firm patented a plan for constructing a long-span single-track railway bridge so that it may later be converted into a double track structure. The cost of the single-track bridge will be but slightly greater than that of the usual structure of that type, yet the total cost, when the second track is added, will not be greatly in excess of that of an ordinary double track bridge.

Throughout these years of great professional activity, Dr. Waddell has continued to contribute his quota to engineering literature. Shortly after settling in Kansas City, he wrote a pamphlet entitled "General Specifications for Highway Bridges of Iron and Steel," which was submitted to prominent bridge constructors throughout the country. A second edition, containing discussions by various engineers and contractors, was distributed about a year later. In 1893 a paper on "Some Disputed Points in Railway Bridge Designing" was written and presented to The American Society of Civil Engineers. This was followed by a paper on the Halsted Street Lift Bridge and a very full and thorough paper on Elevated Railroads, both of which were presented to the same Society.

"De Pontibus," a very valuable book treating of the general principles of designing and detailing bridges and supplementing the usual text books on that subject, was published by Wiley and Sons in 1898. Two years later the