STRENGTH AND DETERMINATION OF THE DIMENSIONS OF STRUCTURES OF IRON AND STEEL WITH REFERENCE TO THE LATEST INVESTIGATIONS

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STRENGTH AND DETERMINATION

OF THE

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OF

STRUCTURES OF IRON AND STEEL

WITH

REFERENCE TO THE LATEST INVESTIGATIONS.

AN ELEMENTARY APPENDIX TO ALL TEXT-BOOKS UPON IRON AND STEEL CONSTRUCTION.

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WITH FOUR LITHOGRAPHED PLATES.

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WITH AN APPENDIX

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CONTENTS.

PART I.

GENERAL PROPERTIES. DETERMINATION OF DIMENSIONS.

PART II.

SHEARING STRENGTH. RIVET CONNECTIONS.

APPENDIX A.

By the Author.

APPENDIX B.

By Prof. R. H. Thurston.

The present English translation of my „Festigkeit und Dimensionenberechnung" has been kindly made by Prof. Du Bois at my special request, and by the courtesy of the Publishers I receive a liberal copyright therefor. No other English translation has been or will be authorized by me.

Stuttgart, 11. March 77. Jacob J Weyrauch.

AUTHOR'S PREFACE TO THE AMERICAN EDITION.

THE methods of calculation of the forces which act upon the various members of our bridges and other structures have, within the last ten years, owing to the united labor of European and American engineers, gained most remarkably in clearness and reliability. These advances can, however, attain their greatest value, only when the question as to what forces these members can sustain with the desired degree of security is satisfactorily disposed of.

That the method of dimensioning thus far in use is an entirely arbitrary one, cannot be denied. In spite of numerous attacks no defence of it has ever been heard. What has for the last hundred years justified the assumption that a piece which has once successfully resisted a certain stress, must necessarily resist equally well an indefinite number of repetitions of that stress? How can it be held that it is a matter of indifference whether a piece is subjected always to the same constant load, or is alternately loaded and then unloaded, or is even subjected to alternate strains of tension and compression? Every layman knows that he can more readily break a piece by bending to and fro than by a steady pull, even though the force exerted in each case be the same.

By assuming the strength, which is *not* constant, as nevertheless constant for every member of a construction, the degree of safety of the different members varies. The least safety of any place in the structure is, however, the measure of the security of the whole. If one member gives way, it is a matter of little moment whether, in falling, the other members hang together or not, and the structure comes to the ground in two or more pieces.

The admirable investigations made during the last eighteen years at the instance of the Prussian Government, have led to results in complete accord with practical sense. The method by which, even before the publication of these results, in the construction of the bridge over the Rhine at Mayence, the strength of the web members was estimated, appears to have been, in all its esssentials, correct. The most important result of the investigations alluded to, however, is "Wöhler's law;" a principle which is, indeed, self-evident, and upon which, in future, every rational method of dimensioning must be based. Immediately after the publication of Wöhler's investigations, the results of which were further confirmed by Spangenberg, new methods of dimensioning were proposed in Germany and Austria. These methods are reviewed and criticised in the Appendix to the present work. These proposed methods are, all of them, not sufficiently developed, and are all, moreover, too closely fitted to the *numerical* results of Wöhler.

The present little work gives a systematic presentation of a new method of dimensioning, based upon two formulæ deduced by Professor Launhardt and by the Author, respectively. It will be noticed that this method, which leaves as to simplicity nothing to be desired, gives considerable economy of material as well as increased security, while the ordinary methods of statical calculation, in general use, remain unaffected by it.

As the resistance of riveted constructions depends directly upon the quality of the rivet connections, I have gived special attention to this hitherto somewhat neglected subject. Without denying the numerous advantages of bolt connections, European engineers use rivets even in frame work, almost exclusively.

In order to make the work serviceable to the practical engineer, I have subjected the numerous experiments upon the strength properties of Iron and Steel recently made in various countries to careful comparison and scrutiny, and