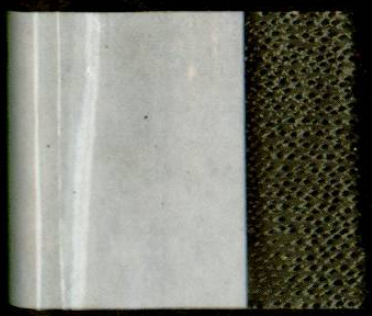

CONSTRUCTIONS - GRAPHICAL STATICS - EDDY.

RESEARCHES

IN

GRAPHICAL STATICS.

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PREFACE.

At a meeting of the American Association for the Advancement of Science, held in August, 1876, at Buffalo, the writer read two papers, entitled respectively, "Certain New Constructions in Graphical Statics," and "A New Fundamental Method in Graphical Statics." These papers, with considerable additions and amplifications, are presented on the following pages; and to them is added a third on *The Theory of Internal Stress.*

The paper, entitled *New Constructions in Graphical Statics*, is largely occupied with the various forms of the elastic arch. The possibility of obtaining a complete graphical solution of the elastic arch in all cases depends upon a theorem not hitherto recognized as to the relative position of the equilibrium curve due to the loading and the curve of the arch itself. The demonstration of this theorem, which may be properly named the Theorem Respecting the Coincidence of Closing Lines, as given on page 12, is somewhat obscure. However, a second demonstration is given on page 98, and this latter, stated at somewhat greater length, may also be found in the *American Journal of Pure and Applied Mathematics*, Vol. I, No. 3. Prof. Wm. Cain, A.M., C.E., has also published a third demonstration in *Van Nostrand's Magazine*, Vol. XVIII. The solution of the elastic arch is further simplified so that it depends upon that of the straight girder of the same cross section. Moreover, it is shown that the processes employed not only serve to obtain the moment, thrust and shear due the loading, but also to obtain those due to changes of temperature, or to any cause which alters the span of the arch. It is not known that a graphical solution of temperature stresses has been heretofore attempted.

A new general theorem is also enunciated which affords the basis for a direct solution of the flexible arch rib, or suspension cable, and its stiffening truss.

These discussions have led to a new graphical solution of the continuous girder in the most general case of variable moment of inertia. This is accompanied by an analytic investigation of the Theorem of Three Moments, in which the general equation of three moments appears for the first time in simple form. This investigation, slightly extended and amplified, may be also found in the *American Journal of Pure and Applied Mathematics*, Vol. I, No. 1.

Intermediate between the elastic and flexible arch is the arch with blockwork joints, such as are found in stone or brick arches. A graphical solution of this problem was given by Poncelet, which may be found in Woodbury's treatise on the *Stability of the Arch*, page 404. Woodbury states that this solution is correct in case of an unsymmetrical arch, but in this he is mistaken. The solution proposed in the following pages is simpler, susceptible