

8TH MARCH, 1889.

ADJOURNED DISCUSSION ON THE CENTENNIAL HALL GIRDERS.

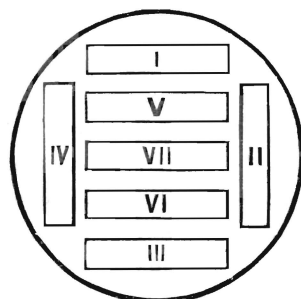
The PRESIDENT, in opening the discussion said it was very desirable that the reason why the Association had taken this matter up should be clearly and distinctly understood, and that he would briefly refer to what practically constituted the justification for so doing. The Judge ruled that the specification in question must be interpreted in accordance with the ordinary reading of the English language. As a professional body of men who had had considerable experience in carrying out practical work; as men who had not only to draw up many specifications, but who for many years had had to interpret and tender for work specified by others, we all knew that mechanical specifications were not, and he would say it deliberately, interpreted in accordance with the English language and that this applied more particularly to the material employed. Such being the case it would be clearly seen that the Judge's ruling, which would be naturally quoted as a "precedent," must form a very important element in deciding similar cases where technical specifications had to be interpreted by a legal Judge, whose decisions must be disastrous to contractors who, during the whole of their experience, had interpreted specifications in accordance with standard practices and trade terms without making any reference to the inconsistency of the two clauses in the specification under discussion, if strictly interpreted in accordance with the English language. He wished to point out very distinctly that "*Staffordshire*" was merely a relative term and meant a quality and not a locality, for as a matter of fact the iron manufactured in Staffordshire came from different counties, and when "*best girder iron*," "*best ship iron*," "*best boiler iron*," "*best charcoal iron*," etc., were spoken of they had separate and distinct meanings which were well understood in the trade, and which were never interpreted in accordance with the literal wording. By the remarks of Professor Warren it was shown

that many specifications drawn by eminent engineers in England were even more indefinite than the one in question. These examples were to him (the President) the most conclusive evidence and strongest possible justification for the Association taking this matter up and discussing it; for had any of those imperfect specifications been taken into the Equity Court the legal interpretation would in all probability have been very different to what was originally intended and totally at variance with the ordinary trade meaning.

Mr. G. FISCHER said in the opening remarks of the last meeting the President had clearly stated the business before the meeting in the following words:—"But there is another view of the same subject which is most material to the profession, and it is this, that if we allow the Judge's *legal interpretation* of a technical specification to pass unchallenged and without criticism it will form a precedent which, in the event of disputes arising, must result in a heavy loss to the contractors who tender for work according to the standard practice and customs of the trade." This was the point we had to consider. Had all the speakers confined themselves to this one point he (Mr. Fischer) would have had very little to add to the remarks already made, except to express a hope that should similar cases arise in the future the Judges, before expressing opinions on technical matters, would consult experts as to the meaning of trade terms and usages. For many years past the practice in Germany had been, in the event of any dispute arising similar to the one under discussion, to appoint one or two assessors who sat with the Judge and advised him on all technical matters, and this had always resulted in a verdict consistent with the technical points of the case. Professor Warren had, however, touched on some matters in the course of discussion which the speaker considered should not pass without comment. Regarding the specifications quoted from by Professor Warren in justification of the one under discussion they were out of date, having been published as far back as 1870, since which time scientific research had made vast strides. It would be needless to give quotations from modern specifications to prove this, as it was

to be assumed that engineers engaged in active practice knew the usages of the day as regards the specifying of qualities of materials to be used in structures. While declining to answer the queries asked by Professor Warren, he wished to show that iron of different homogeneity was used daily in bridge and girder work without giving cause for complaint. His statements were based on the authority of the most eminent experimenters of Europe and would doubtless carry the weight they deserved. Professor Jenny, of the Technical School, Vienna, an institution well known for accuracy of its instruments and investigations, had latterly made a series of experiments on test pieces cut from a 4in. round bar of iron as shown—

FIG. 1.



No. of Test Piece.	Specific Gravity.	Modulus of Elasticity. lbs. per square inch.	Limit of Elasticity, lbs. per square inch.	Ultimate Strength, lb. per square in.	Elongational limit of Elasticity per cent.	Ultimate Elongation after fracture per cent.
I	7.750	27,813,400	18,318	49,252	.066	8.3
II	7.710	29,372,300	20,314	53,637	.070	15.2
III	7.806	28,380,000	19,398	48,078	.068	14.9
IV	7.781	29,615,200	20,860	53,032	.071	16.3
V	7.805	23,229,700	19,288	37,933	.083	2.9
VI	7.750	28,705,900	19,040	45,905	.066	5.9
VII	7.753	25,116,300	18,969	45,737	.076	6.4

Omitting test piece marked V which showed irregularities at the point of fracture, it would be seen by reference to the table that the test pieces showed very marked variations both in moduli

of elasticity and ultimate tensile strength, these variations were to be accounted for by the differences of the forces of molecular cohesion. If they found such variations in the test pieces from the cross-cut section of one individual bar how could they expect a number of bars to be all exactly alike? Hence in practice an average modulus of elasticity was adopted. The variations in the moduli of elasticity gave cause at one time to doubt the applicability of theoretical results, which were based on the assumed homogeneity of the material, to bridge work, and to justify the objection on the ground that bridges as a rule were built up of various elements which could not be expected to possess equal moduli of elasticity, and therefore would not correspond with the assumed homogeneity of the material on which the calculations were based. There could hardly be a doubt that in a structure composed of numerous parts of different extensibility the stresses on the individual parts would be found to vary, as the weaker parts would yield more than the stronger ones whereby the latter would be strained more than the former. Especially in the case of rigid connections between the different parts a shearing stress would be set up at the points of connection which would be transmitted through the fastenings to the less yielding parts causing in the latter a higher stress, which in their turn would cause a greater extension. By this means a condition was ultimately obtained in which a compound bar would behave similarly to an elastic bar of homogeneous material of equal dimensions, but with a different modulus of elasticity, obtained by taking the moduli of the different sections. The case of a compound bar was therefore analogous to the test bar before mentioned. Structures, therefore, composed of different rigidly connected elements, as in rivetted work, must be considered as being constructed of uniformly elastic material. The modulus of the structure as a whole could not be determined in advance, but must be deduced from its behaviour under load. That theoretical results could be applied without hesitation to rivetted structures was sufficiently proved by the results obtained in every day practice which could only testify to the correctness of that assumption.

As regarded Professor Warren's model specification it was somewhat surprising that he omitted to specify the elongation required of the material, especially in view of his anxiety to obtain it perfectly homogeneous, which could only be proved by a test for elongation and not by the contraction of area at fracture, there being no relation between those two properties of the metal. In conclusion he (Mr. Fischer) quite agreed with Professor Warren that specialists should be more regularly consulted in the design of structural iron work for buildings.

MR. MAX THOMSON said that to the minds of those acquainted with the usages of the iron trade the Judge's ruling must appear unfair. The iron was specified to be equal to the "*best Staffordshire*," and with one or two exceptions it could not be denied to be equal to the requirements of the specification as far as it had been tested by him.

With regard to the quotations of Professor Warren from specifications of English engineers he considered them most defective, and not such as he would have work under his supervision carried out to.

Referring to the comments made by Professor Warren regarding his (Mr. Thompson's) connection with the matter under discussion, he wished to state that the Government testing machine was open to the public on payment of certain fees, and although it might not be quite so accurate as the University machine, still he had perfected it so far as to be able to test pieces upwards of twenty feet long both for tension and compression, and to measure the amount of elongation and compression with all the accuracy required for practical purposes.

Application had been made by a Sydney firm to have some samples of iron tested, this was done without his being aware for what purpose it was to be used, and in due course a certificate was issued endorsed as was usual in such cases with a footnote by him stating for what purpose iron according to samples submitted would be suitable. The testing machine was under the immediate charge of a most reliable officer and the results recorded could not be disputed. If the iron was equal in quality to the specimens.

submitted to him, he would pronounce it good enough for the roof or ceiling girders of the Centennial Hall, the purpose for which he had incidently heard it was intended for. At the same time he wished to state that he had not seen the designs for the work. He strongly contended that no comparison could be drawn between railway bridges and the case under discussion, the former being subject to constant live load and the latter to dead load only.

The questions put by Professor Warren he considered of very little practical value.

In drawing up specifications for ironwork he never paid any attention to trade marks or brands, but stipulated for certain tests to be complied with considering that the only way of obtaining the required material.

Mr. DIAMOND said he considered it very desirable that assessors should be called in to advise Judges on technical points in important cases similar to the one under discussion.

Mr. HENRY SELFE said the clauses in the specification were obsolete, and any person framing a specification at the present day when the properties of materials were so well understood should have sufficient knowledge of his requirements to specify what tests of the material were necessary. Concerning the Judge's ruling he wished to say that in his opinion the cheapest iron, provided it sheared clean and did not star in punching, was good enough for girders, his reasons for saying so were: it was never worked or welded, the variations of temperature it was subject to were slight and at the same time both gradual and uniform, and it carried only a dead load, an unvarying quantity. If high tensile strength were required with elongation and ductility he considered steel the best and cheapest material to use.

In cases of the class under discussion the Judge should have the assistance of an expert to advise him on the technical points of the specification.

Mr. A. D. NELSON, at the President's request, moved the following resolution:—"That the Engineering Association of New South Wales dissents from the ruling of the Judge in Equity in the case of Stewart v. the Municipal Council, in his interpretation

of the words used to denote the quality of the iron, which are known as technical, or trade terms ; and further, this Association is of the opinion that assessors should be appointed in all cases where technical or trade terms are used to denote qualities, &c., to assist the judge in arriving at his decision."

Mr. T. WILDRIDGE seconded the resolution, which was then carried.

On the motion of Mr. R. POLLOCK, seconded by Mr. Morse, it was resolved: "That a copy of the foregoing resolution be forwarded to the Minister for Justice."

The PRESIDENT said he sincerely hoped that good would result from the discussion, as they had taken the matter up simply because there was a possibility that in future cases contractors might suffer injury, and this they wished to prevent.

In this part of the work much ingenuity has been displayed — outside of Australia—and many machines are to be had which will do their work ; yet in this there is still much to be done, both in the way of increased speed of working, and in the cheapening of the means of so doing.

The free time presently at my disposal prevents me entering more into detail in this part of the work—indeed I have to crave your forbearance for presenting such crude notes before you at all.

In one way my end is gained if I draw active attention to a great industry, which will more than repay any attention given to it, and which only requires honesty of purpose and intelligence to be directed to it to yield a constant and profitable occupation to a large population.