

I have therefore very much pleasure in moving their adoption.

Mr. HARRICKS: Mr. President, and gentlemen, I can add nothing to Mr. Julius' remarks, but I have very much pleasure in seconding his motion for the adoption of these amendments.

The PRESIDENT: The matter is now before the meeting. Does any other member wish to discuss it in any way? I take it there will be an opportunity at the next meeting also for any point being raised, if so desired, by members.

Mr. TOURNAY-HINDE: Mr. President, and gentlemen, I do not suggest any modification of the proposed amendments to the Rules insofar as concerns their effect in the future; but it has occurred to me that, if we are making a change, the wording of the fourth line of section 5 of the first Rule might be slightly altered. It reads:

“Students or others who seek to be absent from the State for twelve months,” and so on.

Would not it be better if it said:

“Students or others who purpose being absent”?

It is only a small matter, but if we are making changes I think we may as well make the Rule read grammatically. I would suggest the words:

“Students or others who purpose being absent,” or  
“who purpose absenting themselves,” and so on.

The PRESIDENT: Do you agree to that, Mr. Julius?

Mr. JULIUS: Yes; I think it is better to have it so.

The PRESIDENT: Has anyone any other question to raise? If not, I will ask you to vote.

(The motion of Mr. Julius, seconded by Mr. Harricks, that the sheet of Rules as printed, with the amendment in the fourth line of s. 5, p. 1, as suggested by Mr. Tournay-Hinde, was put to the meeting and carried unanimously.)

The PRESIDENT: The chief business before us this evening is the reading by Mr. Hart of his paper, entitled “Building Construction under Modern Acts.”

Mr. ARTHUR J. HART said: Gentlemen, before commencing to read my paper, I should like to mention that there has been recently created at the University of Sydney a Chair of Mechanical Engineering. Our President, Professor Barraclough, is the first to be appointed to the

professorial chair. I have very much pleasure in proposing a motion of congratulation to our President on his appointment.

Mr. W. POOLE: I have very much pleasure in seconding that motion, as I myself was practically a fellow-student with Professor Barraclough when first attending the University. (Loud applause.)

The PRESIDENT: Mr. Hart, Mr. Poole, and gentlemen,—This is a most irregular happening at the commencement of the reading of a paper. It is extremely kind of the members to have thought of it, and I am very much obliged to you for putting it on record in this way.

From the point of view of the alteration at the University, I think, apart from any personal connection with it, it is a desirable thing to have an increase in the number of Chairs—I trust there are still going to be further Chairs, as they are very badly wanted in the University, and exist in every qualified Engineering School. The question here, however—like most other things—is always that of funds; but I think the development which is undoubtedly going to take place in Australia in the coming twenty years we must undoubtedly look to a very large and increasing development in the Engineering School. One of the very encouraging features of the situation during the last four years has been the warm and obviously cordial interest which this Association has taken in the work of the Engineering School. That is, of course, only as it should be if the School and Association are both doing their part—which, perhaps, has not always been so—the relation between the teaching institution of Engineering here, and elsewhere, and what may be called practising engineers, has not been as close as would have been desired. I thank you very much. (Applause.)

Mr. Arthur J. Hart then read a paper entitled “Building Construction under Modern Acts.”

The PRESIDENT: Gentlemen, before the paper Mr. Hart has just read is discussed I will, if you will allow me, read a note received from Mr. Ross in this connection, which is in the following terms:—

“Sydney, 6th July, 1915.

“The Secretary, Engineering Association of N.S.W.,

“Royal Society’s Chambers, Sydney.

“Dear Sir,—I have to thank the Council for their kind invitation to be present at a reading of Mr. Arthur Hart’s paper on ‘Building Construction under Modern Acts,’ but I regret that I cannot attend.

“I have read, however, a draft of the paper, and while the subject matter is one which has always been before us, it is a strong commentary on existing conditions. Particularly important is a clause referring to the more general use of rivets instead of bolts. The existing custom in Sydney to use bolts liberally where rivets should be used should be terminated as soon as possible in the interests of durability and strength.

“Also, I would refer for a moment to the question of wind pressure, especially as one well-known building not far from the city boundary was constructed some years ago apparently without any bracing whatever to take charge of wind pressure. Of course such buildings get protection from their surroundings, but the liability to a local whirlwind, which takes little account of surrounding structures, has always to be faced. However, the question of lateral wind pressure on structures is a very doubtful one; indeed, in the case of some large cylindrical structures, such as gas-holders, the old idea of wind pressure has now been entirely modified, being far less than would be expected from small experiments.

“The author of this paper covers quite a large range, and obviously is only able to touch lightly upon many interesting subjects which would open a large field of discussion, and I think he is to be congratulated upon a very clear summary of an existing constructional situation.—Yours faithfully,  
 “(Sgd.) HERBERT E. ROSS.”

The meeting then terminated.

Signed S. H. E. BARRACLOUGH, President.

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Minutes of the meeting held at the Society's Rooms, 5 Elizabeth-street, Sydney, on 12th August, 1915.

Present.—The President, Professor S. H. E. Barraclough, in the chair, and about 200 visitors.

Minutes.—The minutes of the previous meeting, held on the 7th July, were read and confirmed.

The President, in opening the proceedings, said: At the last meeting, gentlemen, you will remember that the amended Rules and By-laws were put before you for consideration, and, in accordance with the constitution of the Association, they have again to be brought before this meeting. I do not think there is any necessity to read them, as they have been circulated now to each member, and were considered at the last meeting. I will ask some member of the Association to move their adoption.

Mr. JULIUS: I formally move the adoption of the amended Rules and By-laws.

Mr. SAUNDERS: I beg to second that.

(On the motion being put to the meeting, it was carried unanimously.)

The PRESIDENT: I declare the amended Rules and By-laws now carried.

I have to announce (on behalf of the Students' Association) that at the next meeting, on the 25th August, there will be a discussion on Professor Coker's Professorial Address to the British Association for the Advancement of Science, delivered in Sydney in August, 1914.

Gentlemen, I am sure, on behalf of the members of the Association, that I am expressing your desires when I extend a very cordial welcome to the members of the Munitions Committee, and to the representatives of other scientific and technical societies, as well as to our guests here this evening; we are very glad that they have been able to come and take part in this discussion. (Applause.)

I will now ask Mr. Harricks to read us his paper, or, as he desires it to be called, a description of a number of slides he has prepared on "The Manufacture of Small Artillery Shells," and after that I will ask members, and visitors if they will, to take part in the discussion.

Mr. HARRICKS: Mr. President and gentlemen, before commencing the real business of the evening, it was considered proper to present to our members a complete list of names of their comrades who are at the front. I am quite sure that our visitors will be the first to honor them.

Mr. Harricks then read his paper.

At the conclusion of the exhibition of the lantern slides Mr. Harricks said: Before leaving the subject to discussion, I should like to express my thanks to Mr. Clayton, a member, and to our Honorary Secretary for their co-operation with me in this matter. I can only hope that our efforts will help to some extent to bring about the result we all, no doubt, so earnestly desire, although, up to the present, the matter has not received the attention it deserves.

If anyone had suggested six months ago that I should be prepared to stand up before an audience in Sydney and give even a meagre description—such as I have to-night—on the subject of munitions, I should have thought them

mad, and I can only mention this by way of apology for the very poor manner in which I have tried to illustrate the important subject put before you to-night.

The proceedings then terminated.

Signed S. H. E. BARRACLOUGH, President.

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Minutes of meeting held at the Society's Rooms, 5 Elizabeth-street, Sydney, on Thursday, 9th September, 1915:—

Present.—The President, Professor S. H. E. Barraclough, in the chair, and about 50 members.

Minutes.—The minutes of the previous meeting were read and confirmed.

The PRESIDENT: The next business, according to the Constitution, is the election of Auditors, who have to be elected at this meeting.

Mr. Wm. Poole and Mr. G. W. F. Findlay were elected as Scrutineers for the election of Council.

Mr. W. P. Small and Mr. A. W. Tournay-Hinde were elected as Auditors for the year.

The President, in opening the proceedings, said: I have to announce that the next Students' Meeting will be held on Wednesday, 21st September.

The business set down for this evening is a paper by Mr. Bragg on the question of weighing machines. Unfortunately, Mr. Bragg has had to go to Melbourne, and cannot be here this evening; but Mr. Jones has very kindly consented to read the paper in Mr. Bragg's place.

Mr. Jones then read a paper by Mr. J. W. Bragg, entitled "Weights, Measures, and Balances," which was illustrated by lantern slides.

The PRESIDENT: I am sure, gentlemen, you will all agree that we have had an extremely interesting paper, and I will ask Mr. Julius to say something about it.

Mr. G. A. JULIUS: Mr. President and gentlemen, I have learnt something to-night dealing with a matter which is of interest to all of us who are using our standards every day. I expect very few of us, like myself, knew anything whatever regarding the correspondence of standards, or their origin. The paper which Mr. Bragg has prepared is of very great interest, but does not allow for any discussion, and, beyond a possible anxiety on the part of some of

our Scotch friends as of the reasons of the abandonment of the Scotch pint, I do not think there is anything that calls for any special remark.

I have very much pleasure in moving a vote of thanks to Mr. Bragg for his paper, and to Mr. Jones for reading it.

Mr. FILDERS: I have very much pleasure in seconding the vote of thanks to Mr. Bragg for the very interesting paper we have listened to this evening.

Mr. HARRICKS said: I would like to add my support to the vote of thanks which has been proposed to Mr. Bragg for his interesting paper, and to Mr. Jones who has read it. Mr. Julius has pointed out that as the author has not dealt with the commercial side there is really very little left for discussion. Mr. Bragg referred in his paper to the English measurements as a defect in our Imperial standards. I was only reading a few days ago a very able article about the old question of the metric versus the English standards, and the author stated that Great Britain, in rigidly adhering to the Imperial standards, had emphasised a fact which was going to operate very disadvantageously in regard to the endeavour the nation is making to recover a good deal of her lost trade. America appears to be the only other important nation using a similar standard, and she was very rapidly giving it up and adopting the metric system.

Mr. Bragg has taken us in a very interesting manner into the past, and recently when on a trip abroad it was my business to look into the question of weighing machines of a certain kind for commercial purposes, but the following incident was not in any way sought after or expected. In a certain village in the south of Ireland, we had occasion to purchase a little maize, and the farmer produced from his bin an inoffensive looking tin measure, which he called by some name I could not understand. I took particular notice, in order to see whether this measure had any direct relation with any known standard, but as far as I could judge it had not. On making enquiries, I learnt it was not an unusual thing, but that in many of the farming districts of Great Britain there were certain measures which had no direct relation to known standards, but were purely local and customary. The denominations, practically inexplicable, and, although distinctly illegal, have been used, and perhaps will be for many years to come. It is also interesting to note from Mr. Bragg's paper that even in the time of the Romans many of the steel yards

dispensed with the loose weight, and when one has had any experience of modern weighing machines one can thoroughly appreciate the value of these without any loose weights as against machines that require them. One cannot help wondering how, in the course of time, we ever departed from the convenient no-loose weight steel-yard, as was apparently used by the Romans. I think perhaps one of the most interesting historical references in Mr. Bragg's paper was with regard to the tally-stick. It is perhaps worth noting that British engineers are trying very hard to standardise the gauges for metal plates and wires. We know that in Great Britain four gauges are now largely used, and there seems no sufficient reason why a standard could not be adopted.

Mr. Bragg's paper has been exceedingly interesting, particularly from the historical point of view, and has reminded us of the ingenuity of those who have brought weighing and measuring devices to their present standard of excellence.

MR. WALTER REEKS said: I have nothing to say about the barleycorns to-night. I said all I have to say at our last meeting. There is one standard of measure which is, I think, essentially Australian, with regard to a horse's feed. When I learnt my tables at school I was taught that two gallons made one peck, and four pecks made one bushel. I think it should be placed on record that one kerosene tin is one horse's feed.

MR. TOURNEY-HINDE said: I am very pleased to support the vote of thanks to Mr. Bragg for his interesting paper on Weighing Machines, and to Mr. Jones for reading it.

Mr. Bragg must have been put to a great deal of work to prepare the very exhaustive and interesting historical and other data relative to the subject. There is, however, one class of weighing machine that the author has omitted to include; I allude to the multi-beam platform scale that is principally used by smelting and other works when it is desired to weigh up a mixture of various materials, and which is so designed that it obviates the necessity of setting the weight on the steelyard for each of the materials to be weighed. In this type of scale there is one main steelyard which is usually reserved for the tare of the truck or other vessel in which the mixture is to be weighed, and below it are a number of other steelyards according to the number of ingredients in the mixture to be weighed up. Each of these is so arranged that it can be connected to the main

steelyard by the movement of a small lever. The weights of each of the several ingredients are each set on one of the lower steelyards, and as the mixture is made up the proper steelyard for weighing the particular portion of the mixture then being added is connected to the main steelyard. The adjustment of the weights on each of the lower steelyards is usually made by an official in charge, and they are so arranged that they can be locked up. By this means it is possible to have the men make up a mixture by weight without knowing the weights of each of the component parts of the mixture, and this feature is of much value in certain commercial operations. I know the matter has merely slipped Mr. Bragg's notice, and I feel sure that he will include it amongst the very interesting collection of apparatus he has described to us this evening. Unless anyone has had experience with them, and has been responsible for their satisfactory operation, the ordinary weighing machine and weigh-bridge would appear to be a somewhat rough and crude machine. Such, however, is not the case. Although the parts are apparently very heavy, and some called, for want of a better term, "knife-edges," they are anything but a knife-edge; but the degree of accuracy that can be obtained, and also maintained, in every-day operation, is remarkable. In one case that has come under my notice, it was the custom to weigh up truck-loads of 10 or 15 tons in drafts of one ton on a platform scale, and then to check the lot by weighing in one draft on a weigh-bridge. In everyday operation it was found possible to keep the weights recorded by the two scales within .01 per cent. of each other.

Some of the assay balances described by the author are indeed very fine specimens. Some English and American makers of this class of scale turn out very high-class apparatus indeed. On such machines it is quite possible to weigh a cigarette paper, then write one's name on it in lead-pencil, and reweigh and determine the weight of the signature.

With regard to the placing of the centres of a steelyard, theoretically the three centres—the one supporting the weight, the one supporting the steelyard, and the one carrying the small weight that balances the heavy load—should be in a straight line, but when so constructed it is almost impossible to determine the particular moment when the weights balance—the whole arrangement is comparatively unstable. To overcome this, the centres are generally slightly out of line. English makers generally place the



fulcrum centre of the level below the other two, so that when equal or equivalent weights are on the end of the lever it will drop over to one side or the other. American makers, on the other hand, place it a little higher, with the result that, when the weights are equal, the lever swings gently up and down. To the uninitiated this latter method produces what appears to be a more accurate weighing machine.

I have much pleasure in supporting the motion.

MR. WM. POOLE said: I think it was a great pity, when the Imperial system was introduced, that a more rational one was not adopted. It has been called a "system"; it would be much fairer to call it a chaos. We had three different systems of weight—Apothecary's, Avoirdupois, and Troy—and very few people, except those continually dealing with them, know the exact relationship of one to the other. On the other hand, in the Metric system, there are easy connections between measures in length, weight, or capacity where the whole of these are in co-ordination. If the Metric system were introduced it would cut out about three-fourths of the troubles of schoolboys in their mathematics; that is to say, boys of 10 or 12 years would be able to do almost all necessary computations instead of having to wade through many years of complicated and unnecessary work. One instance may be given of the complication of our present system, viz.: there is such a variety of ways to denote measures of length—some things are measured by the inch, some by the foot or yard, by the chain, and also by the link. The chain itself is not always the same, because there is the ordinary land surveyors' chain, 66 feet long, containing 100 links, and the engineers' chain of 100 feet long. Here we have a chain of 66 feet and another of 100 feet.

Mr. Bragg, in his paper, referred to assay balances in which the 1-200th of a milligram was measured. Many such instruments are now made to weigh positively to about 1-600th—that is, one-third of that. Mr. Tournay-Hinde has just now told us that we could ascertain the weight of a man's signature; we could get very much less than that in many of these machines. A small amount of condensation would be absolutely fatal to accurately weighing a very small amount; in fact, a point well known to chemists is that if you weigh a hot body you will get a continual variation of weight, due to the induced air currents, and it is one

of the essentials in a laboratory that heated bodies must be allowed to cool down to atmospheric temperature, otherwise it would be impossible to get an accurate weighing.

It is not usually recognised that the commercial use of the Metric system is legal in Great Britain, and also Australia, and that commercial transactions can be made in the Metric system, and not necessarily the Imperial measures. The American measures which have been referred to are practically identical with the Old English measures, which were in existence before the Imperial measures were brought in. The American system represents more nearly the Old English system than the later Imperial measures. I think it is a great pity, when the English systems were changed with many alterations to the Imperial measures, that a more rational system was not introduced. (Applause).

The PRESIDENT said: I am sure, gentlemen, it requires no observations on my part to commend this motion to the meeting. It has, I think, been a very interesting evening. I think we are to be congratulated on having what might be called some change from our ordinary run of technical papers. One is rather inclined to think of our work as running on definite scientific lines, and being somewhat cast-iron in its methods; it is very interesting indeed to have a paper like this which brings our work more in touch with the history of things, and with the development of human society generally. I thought the early historical portion of Mr. Bragg's paper was extremely interesting, as it enabled us to see how the question of weights and measures in Greek and Egyptian days attracted public attention.

With reference to that well-known picture in the Book of the Dead (one of the very striking objects that one is accustomed to look at), a reproduction of the Book of the Dead was presented by someone to the University a few years ago. It is in the form of a parchment about 70 feet long and 2 feet wide, in a long case, and that particular picture can be seen. Although at first sight one might not think that the question of Weights and Measures would be so very interesting, if one considers for a moment and thinks of the controversies which always range around subjects, one alters that opinion somewhat. I do not know whether you noticed how, at our last meeting, we had a large number of people here to discuss the question of Munitions, when someone introduced the question of the Standard of

Measurement. The question of units of measurement, and the standards, is a matter which has always, for some reason or other, attracted tremendous interest on the part of the people. The controversies around weights and measures, and different systems, have, from time immemorial, been without end. I believe that Mr. Poole, on the slightest encouragement, would have gone on, on this subject, until he was interrupted. I myself have always been interested, although in a theoretical kind of way. We have not the other system for our purposes of comparative trading with other nations, and it is very difficult to know when we are going to begin. I agree with Mr. Poole that it would lessen the actual time spent by children in learning by an absolutely extraordinary amount, and it would probably reduce the quantity of work that a schoolboy would have to do by at least 70 or 80 per cent—the work would practically disappear. Of course, there would be great difficulty all their lives—every generation would have the difficulty that they would have known a new system, and they would find that the whole world worked in using an old system, and probably the confusion might be worse than before.

I do not know whether you remember a particular scheme proposed for a decimal system based upon our inch as a unit. It had a great deal to support it, but I think myself it was killed by the names that the founders adopted. They had the inch as the original unit, and multiples of that went by an extremely curious set of names.

It is interesting to notice, as Mr. Poole pointed out, that the use of the decimal system is quite legal in Great Britain. I also think it is legal in the Commonwealth, but, of course, it is a very different thing to make a scheme which is legal compulsory; whether it will ever come to that I do not know.

Taking the question of bullion and assay balances, it is rather interesting to notice that probably the most notable of them was designed by a man who was in Australia—Professor Steele, Professor of Chemistry in the University of Brisbane. Probably his most noticeable achievement was his design of his balance for the weighing of bullion; I could not off-hand give the figures, but it achieved a refinement of measurement which far exceeded anything previously obtainable.

One other class of machine which is interesting to refer to, which carries out weighing under extremely difficult circumstances, is a testing machine for materials. Most

weighing machines are some modification of a steelyard, but these machines are so constructed that whenever a piece of material is broken, and you have very difficult circumstances to deal with, the accuracy obtained in these machines for testing materials is very striking.

I think, in the last couple of years, we have had occasion to standardise practically all the testing machines in N.S.W. There are a number of machines at the University of Melbourne: there is one at the Railway Station, one at Cockatoo Dock, one at Lithgow Steel Works, and a couple recently in the Newcastle district. They are standardised by means of delicate machinery, steel bars being used for the measurement devices of the weighing machines. The steel bars are made in the testing laboratory of Schaffenberg (?) in Germany, and they are tested for elasticity. The elasticity is measured against actual weights up to 30 tons. These bars are themselves practically, to begin with, calibrated springs. One of these is put into a testing machine, and you measure the elasticity against that bar, and from that you deduce the accuracy of the machine. It is very interesting to see how very good, practically, all the machines are, and, further, how accuracy is maintained through a wide range. There is a testing machine which varies in its load, testing materials from 5 tons up to 100 tons or 200 tons as the case may be. That type of machine is, I think, worth noticing in connection with weighing machines.

The motion is, that we should record our very warm thanks to Mr. Bragg for his very interesting paper, and very interesting set of slides which accompanied it, and also to Mr. Jones for having performed what is a very hard task, viz.: that of reading someone else's paper.

The motion was put to the meeting, and carried with acclamation.

MR. JONES, on behalf of Mr. Bragg, acknowledged the vote of thanks.

The proceedings terminated.