A Review of National Certificate Schemes*

Mr. D. A. Eaton, B.Sc.(Eng.) (Chairman), in inviting Mr. C. H. Taylor-Cook, B.Sc.(Eng.) (Member) to open the discussion, said the subject was of considerable interest to marine engineers, as a number of junior engineers took advantage of the National Certificate and Higher National Certificate to gain exemption from Part A of both the Second and First Class Ministry of Transport Certificate Examinations, and also as part of their Institute examinations.

MR. TAYLOR-COOK introduced the subject for discussion as follows:

INTRODUCTION

The title of his paper was "A Review of National Certificate Schemes." No doubt many of his audience already had a considerable knowledge of these courses and he craved their indulgence for including full details for the benefit of those who were not familiar with the schemes.

HISTORY OF SCHEME

National Certificates in mechanical engineering were started in 1922 by the Institution of Mechanical Engineers in conjunction with what was then the Board of Education. It was interesting to recall the words of Professor H. S. Hele-Shaw, who was then the President of the Institution, in his Presidential Address in October 1922. He quoted:

> "I will now deal with one education event, that has occurred during the past year, which I venture to think is one of the most remarkable steps forward that our Institution has ever taken towards the control of the education of mechanical engineers: National Certificates and Diplomas in Mechanical Engineering.
>
> "From what I have said about recognition of our own examinations, all members will realise that we are in a position of insisting on certain educational qualifications which necessarily involve preparation in order to produce evidence for this. But the event of the year to which I have just alluded is the action of the Board of Education in putting us in a position to share with it in the control of the education—not merely of a large number of those who become members of the Institution, but of those engaged in the work of mechanical engineering who are attending the day or evening classes of technical colleges or schools—that is to say, pupils, apprentices, improvers, and skilled mechanics as well as draughtsmen, foremen and managers of engineering works.
>
> "An important question arises as to how far these certificates are to be recognized by the Institution as a substitute for excusing part or the whole of its own examinations. You may be sure that while, on the one hand, the interests of our Students, Graduates and Corporate Members, and those who have passed our own examinations, will be duly safeguarded, and our present high standard maintained, every effort will be made to ensure that there shall be no distinction whatever made between those who have been able to secure the highest education at a college or university and the young engineer who, by force of circumstances, has been debarred from this privilege. The former will have no unfair advantage over the deserving apprentice who has been able to secure his education only from Board Schools, and at evening classes in proximity to the engineering works where he is employed."

Note that while reference was made to the possibility of exemption from the Institution's examinations, emphasis was placed on the education of those who did not aspire to corporate membership.

In 1922, 46 Colleges entered candidates for the examination. By 1938, this had increased to 146 and since then the number had risen steadily to 246 (Fig. 1). The corresponding

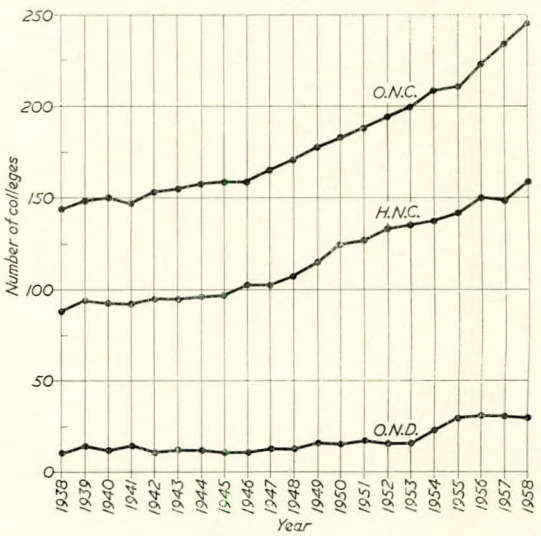

FIG. 1

increase in Colleges offering H.N.C.(Mech.) was from 21 in 1922 to 85 in 1938 and 157 in 1958. This provided a mute comment on the soundness of the base on which the scheme was founded.

GENERAL CONDITIONS FOR AWARD

National Certificates were for part-time students and part-time students only. The only departure from this was for the emergency intensive schemes during the last War when the usual two years of part-time study were compressed into six months of full-time study. The part-time study might be

* Discussion held by the Institute of Marine Engineers' Education Group following their Annual General Meeting on 17th March 1959.

classes on one whole day and one evening per week. A typical scheme was as follows (Table I). This showed a

TABLE I.—MECHANICAL ENGINEERING

(i) Ordinary National Certificate

First year	Hr.	Second year	Hr.	Third year	Hr.
Mathematics	68	Mathematics	68	Mathematics	65
Engineering science*	68	Engineering science*	68	Applied mechanics*	65
Engineering drawing	65	Engineering drawing	65	Applied heat*	65
English	34	English	36	Principles of electricity*	61
Physics and chemistry*	34	Principles of electricity*	34		

(ii) Higher National Certificate

First year	Hr.	Second year	Hr.
Mathematics	65	Strength of materials*	65
Applied mechanics*	85	Theory of machines*	65
Applied thermodynamics*	85	Applied thermo-dynamics*	65
Principles of electricity*	45	Electrotechnology*	65

*For these subjects, one-third of the time is spent in the laboratory.

entirely in the evenings or, as was more usual these days, by scheme for O.N.C. and H.N.C. on a part-time day release course. Note that the O.N.C. was designed to take three years and the H.N.C. a further two years. Some H.N.C. schemes (notably those in civil engineering) were based on three years' study. The usual conditions for entry to the first year of an O.N.C. course were a minimum age of 16, and either full-time education up to the age of 16 or completion of a suitable preliminary course. Not all the subjects shown in this scheme were essential for the award of a certificate. The first three in each year were the compulsory ones, and these were the ones that were usually studied when attendance was only in the evenings.

The Ministry of Education now demanded at least 150 hours per year, with a total of not less than 540 hours in the three years of the O.N.C. course and not less than 360 hours in the two years of the H.N.C. course. These figures might be affected by the requirements of the professional institutions, as he would mention later.

The appreciation by industry and by students of a qualification with national recognition was shown by the increase in the number of candidates. Those for O.N.C.(Mech.) rose

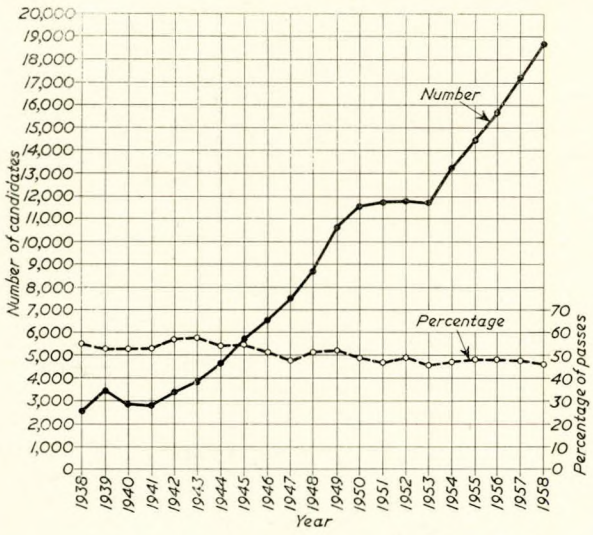

FIG. 2—*Ordinary National Certificate (Mechanical Engineering)*

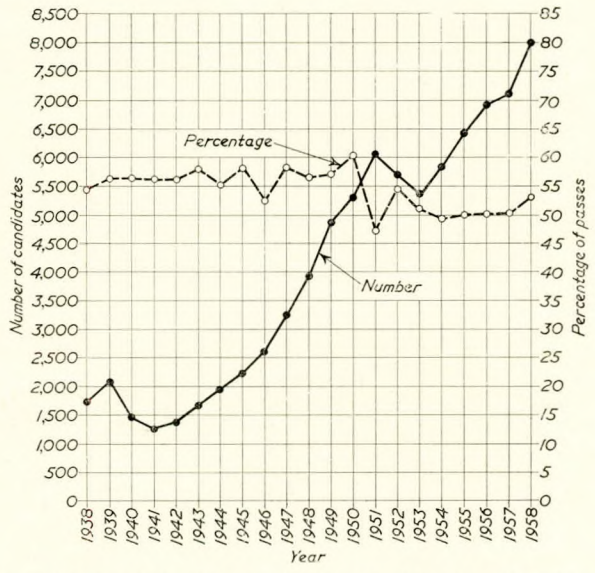

FIG. 3—*National Certificates in Electrical Engineering, England and Wales (Ordinary Certificate). Graph does not include endorsement candidates. (Document No. 5200/353.)*

from 1,021 in 1922 to 2,646 in 1938 and thereafter as shown in Fig. 2; those for O.N.C.(Elect.) since 1938 were shown in Fig. 3; those for H.N.C.(Mech.) rose from 104 in 1922 to 699 in 1938 and thereafter as shown in Fig. 4; and those for H.N.C.(Elect.) since 1938 were shown in Fig. 5. Note also the percentage of successes in the examinations—not much variation since the schemes first started. Was this a desirable percentage or should it be higher? The standard of the examination had certainly risen. Were colleges admitting students to the course who were not capable of completing it? He had known many students who managed the O.N.C. course quite well, but found the H.N.C. course quite beyond their capability.

ORGANIZATION OF A COURSE

How were these courses organized and conducted? One

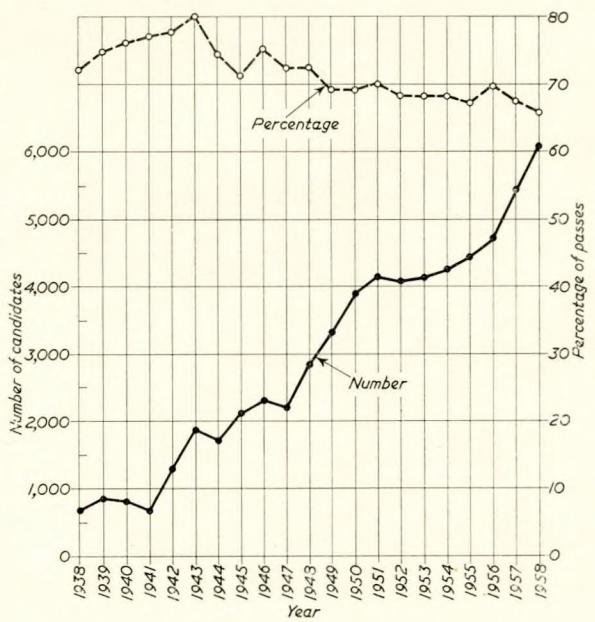

FIG. 4—*Higher National Certificate (Mechanical Engineering)*

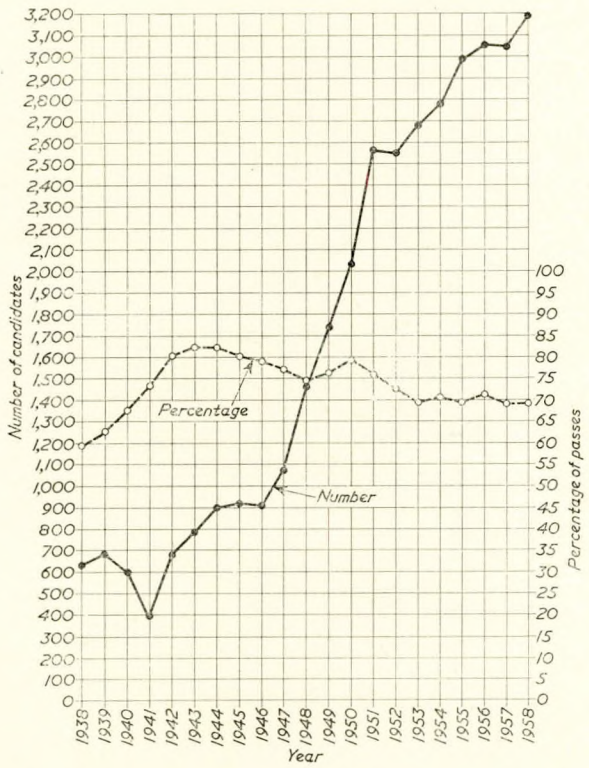

FIG. 5—*National Certificates in Electrical Engineering, England and Wales (Higher Certificate). Graph does not include A1 or endorsement candidates. (Document No. 5200/354.)*

of the fundamental principles was that, although it was a National Certificate, there was no national syllabus. Provision was made for variation in subjects and syllabuses to suit local conditions. Indeed, many colleges prepared their own syllabuses, although, in some areas, it was possible to enter students for examinations held by an area examining authority such as the Union of Lancashire and Cheshire Institutes, the Union of Educational Institutions, or other similar bodies.

If a College were preparing its own scheme, it must submit its syllabuses through the Ministry of Education to the appropriate Joint Committee on which the professional institutions were also represented. Much more information than the syllabuses was required. Full details of the timetable and of the qualifications of the staff who were to do the teaching were required. Almost certainly there would be a visit from one of Her Majesty's Inspectors to ensure that the accommodation, particularly laboratories and the equipment therein, was adequate. Details of the proposed methods of recording the progress of students during the course would also be required.

Once these proposals were approved, the conduct of the course, at least for the first two years of the O.N.C. course, was left to the college (subject to periodical inspection). The examinations were internal, set and marked by the college staff, and records of attendance, homework marks and laboratory work marks must be kept. During the third and final year, there was a slight change. The examination paper was prepared by the college staff but was then submitted to an assessor appointed by the professional institution. After the scripts had been marked, they also were submitted to the assessor. Finally, a full record of the three years' work, attendance, homework, laboratory work and examinations, was sent to the professional institution. Several conditions must be satisfied for the award of the certificate:

(a) not less than 60 per cent attendance in each year;
(b) not less than 40 per cent for any one mark, i.e., homework, laboratory work or examination; and
(c) for the final year, the figure obtained by taking 0·7 of the average examination mark and 0·3 of the average mark for homework and laboratory work must not be less than 50 per cent.

It would be seen, therefore, that it was not possible for a student to obtain this qualification by dilatory attendance and poor work during the session, followed by intensive study leading to the attainment of a 40 per cent mark in the examination.

ENDORSEMENT SUBJECTS

Provision was made in the scheme for the award of 'endorsement' certificates for additional subjects studied to the same standard. These endorsements could be either on the O.N.C. or on the H.N.C. Similar conditions to those detailed above apply to the attendance, homework and laboratory work and the pass level in the examination was 50 per cent.

NATIONAL DIPLOMAS

Qualifications of a standard similar to that for the Certificates but intended for full-time students were known as National Diplomas. The Ordinary National Diploma required two years of full-time study from a student who had had full-time education up to the age of 16; the Higher Diploma required three years of full-time study from a student who had had full-time education up to the age of 18 or who had had two years in regular employment with concurrent part-time study. The scheme of particular interest in the present circumstances is that in connexion with the training of marine engineers (Table II). To be awarded a Diploma, the candidate must pass in mathematics, applied mechanics, heat engines and engineering drawing, together with two subjects from principles of electricity, workshop technology and physics with chemistry. Naval architecture was an optional endorsement subject.

Fig. 6 showed the numbers of entries for the Ordinary National Diploma, together with the percentage of passes.

TABLE II.—NATIONAL DIPLOMA COURSE

	First year, hr.	Second year, hr.
Mathematics	133	133
Applied mechanics	133	133
Heat engines	133	133
Workshop technology	114	114
Principles of electricity	114	133
Physics and chemistry	114	114
Engineering drawing	114	133
English	114	95
Workshop practice	209	190
Naval architecture	95	114
Swimming and P.T.	57	57

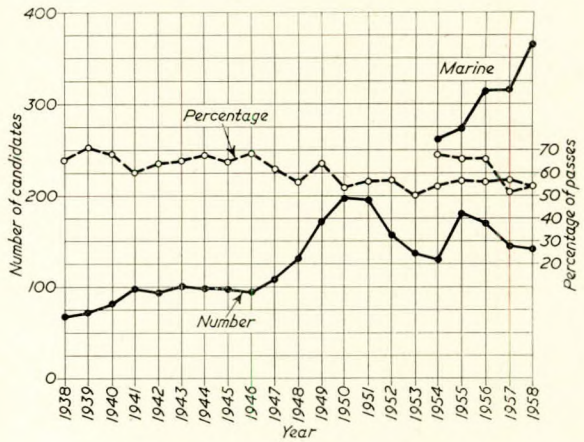

FIG. 6—*Ordinary National Diploma (Mechanical Engineering)*

EXEMPTIONS FROM PARTS OF THE COURSES

As the pattern of primary and secondary education had changed, so the education which would be accepted in lieu of some years of the O.N.C. course had also changed. At present, a candidate who had satisfactorily completed a three-year course at a secondary technical school after the age of 13 might be admitted direct to the second year. This exemption would be withdrawn this year. He regretted this and would like to see it continued under suitable safeguards. These would be: (1) that the school was closely connected with a senior college; and (2) that the decision on whether the course had in fact been *satisfactorily* completed was made by the college principal.

Almost the only exemption left for a student coming straight from school was expressed in terms of the G.C.E. If a candidate held the G.C.E. in mathematics, a suitable science subject (general science, physics or mechanics) and two other subjects, he might be admitted direct to the second year provided that he also qualified in the first year engineering drawing. He was not very happy about this and felt that the two other subjects should be controlled more closely (he suggested English and geometrical drawing) as it was found that many such students did not progress as well as expected.

Exemption from the first year was also granted to a candidate who held the City and Guilds Intermediate Certificate in machine shop engineering.

EXEMPTIONS FOR HOLDERS OF THE CERTIFICATES

One of the most powerful factors in the development of National Certificates had been their acceptance by the professional institutions as exemptions from parts of their examination requirements for corporate membership. Far more members entered the institutions *via* National Certificate courses than by the Institution's own examinations.

The majority of the institutions accepted O.N.C. in lieu of Part 1 on a subject for subject basis. The Institute of Marine Engineers accepted the H.N.C. in lieu of Part II on the same basis. The Institution of Mechanical Engineers used to accept the H.N.C. in lieu of Part II also on the same basis, but they were now stiffening their requirements. They now specified the minimum hours for certain subjects, e.g. 120 hours for Principles of Electricity, 60 hours on heat and 60 hours on light and sound for the Part I subject of Heat, Light and Sound, 100 hours on any assessed subject in the H.N.C. They also required a level of 50 per cent in each assessed subject if it was to qualify for exemption.

The Institution was careful to point out the difference between those students who aspired to corporate membership and those who could not hope to proceed beyond H.N.C. level, and stated: "the normal National Certificate Courses should not be extended in either duration or content or the tempo accelerated beyond what is reasonable for the student who does not wish to obtain exemption."

One could not, of course, presume to criticize any institution for any steps that they might take to maintain their own standards of admission, but one might wonder whether the very close connexion between the National Certificate courses and professional requirements was undiluted benefit. Any college submitting a scheme which it hoped would qualify for exemption was naturally tempted—more than that—pressed to model its syllabuses on those of the institutions. The standard of the examination had risen with the standard of the institution's entry requirements. Almost every student said that he wanted exemption from some institution's requirements. Soon it would be impossible for a student who had obtained his H.N.C. on the minimum number of subjects to obtain any exemptions for his H.N.C. subjects, because he had not completed Part I before proceeding to H.N.C. Was a college to inform a student early in his studies that he had no hope of achieving this? Did the pressure of institution requirements not tend to reduce the flexibility and adaptability to local requirements that were usually considered to be essential features of the scheme?

The Ministry of Transport and Civil Aviation used to accept an assessed S2 drawing examination for exemption. They now demanded an S3 level, something that was not very common in colleges, and a standard that was not demanded by the professional institutions. Recently, they had imposed a further condition on the acceptance of S3 Applied Heat—that it should have been obtained at a college which also covered the subject of Thermodynamics in the H.N.C. course.

All these conditions imposed pressure on National Certificate courses which he considered were not for the benefit of the courses. It seemed to him that there was a tendency to forget that the National Certificate was a very desirable qualification in its own right and was so recognized by industry. It would be very regrettable if this tendency persisted and increased.

In conclusion he hoped that he had trailed his coat sufficiently to provoke discussion. He thanked the Institution of Mechanical Engineers and the Institution of Electrical Engineers for the provision of statistics, and the Institute for help in the preparation of slides, and finally, as an officer of the London County Council, he must state that any views put forward in this review were his own and did not necessarily represent the policy of the L.C.C.

Discussion

The CHAIRMAN said that Mr. Taylor-Cook had given a very wide survey of developments and matters appertaining to the National and Higher National Certificate courses which should lead to a lively discussion.

MR. J. MCAFEE (Member) asked Mr. Taylor-Cook to explain the symbols S1, S2 and S3. He said he had often seen them used but was not sure of their exact meaning.

Secondly, did he understand that under the present examination systems in this country for National Certificates or for membership of professional institutions it was now quite impossible for a young man living, say, in the Outer Hebrides or some other remote part of the country where there was no technical college he could attend for the requisite number of hours, to obtain a National Certificate or qualify for a professional institution? Was that correct?

MR. TAYLOR-COOK replied that S1, S2 and S3 were the first, second and third years of the O.N.C. scheme. It derived from the connotation used by the Ministry whereby the O.N.C. was called a senior scheme. Hence, S1, S2 and S3. The H.N.C. was an advanced scheme and therefore A1, A2 and possibly A3 related to H.N.C. schemes.

If a student could not attend a college, he could not get a National Certificate. It was an essential requirement that he should attend an approved course at a college. But that

did not debar him from membership of an institution, because there was only one professional institution, as far as he knew, that demanded attendance at a course—the Institution of Electrical Engineers. The others did not mind how their students prepared but they must take the institution examinations and not the National Certificate examinations.

THE CHAIRMAN said he thought that under the National Certificate scheme a candidate must pass at S.1 level before being eligible for entry into S.2, and the same applied at other levels.

The necessity to pass at one stage before entry to the next was the equivalent of a qualifying examination.

MR. TAYLOR-COOK: Yes.

MR. MCAFEE asked whether Mr. Taylor-Cook had not said that, for mechanical engineering, attendance was necessary in order to sit for various sections of the examination.

MR. TAYLOR-COOK replied that attendance was required only for the National Certificate. The Institution of Mechanical Engineers had their own examination requirements, but they did not specify attendance.

PROFESSOR G. H. CHAMBERS, D.S.C. (Member) thanked Mr. Taylor-Cook for a most interesting talk.

He asked whether the number of candidates shown on the slides were the number who started the course or the number who left at the end. One wondered how many stayed in the running, as it were, until the end.

Secondly, there appeared to be a tendency on the part of the Institution of Mechanical Engineers to raise the standard. This would tend to lower even further the present not very high and falling proportion of passes. Could Mr. Taylor-Cook say something about that?

MR. TAYLOR-COOK replied that the figures shown on the screen represented the actual candidates for the final examination, not those who started the course. The number of those who started the course, particularly the O.N.C. course, would be considerably higher than those who completed S3. The wastage, particularly during S1 and S2, the first and second years of the course, was far higher than anyone liked to see, and considerable attention was being devoted at present to investigating the cause and seeing whether too many unsuitable candidates started the course.

The standard of the examination had been going up right from the beginning, and there was a vast difference between the papers for the H.N.C. examination he had taken in 1930 and those of the present day. But there was not such a vast difference in the percentage of passes. It seemed to remain fairly constant, even though the standard was constantly rising.

MR. P. J. HOWARD, B.Sc.(Eng.) (Associate Member) said S1 exemption required G.C.E. in two subjects (mathematics and science) and two others—beekeeping, Zulu, and so on. He thought exemption was only recommended by the principal of the college if he were satisfied that the student was suitable for S2. Speaking for himself, he had had many students with that sort of qualification, but they did not go into S2 unless he was satisfied that their background was suitable as well.

Secondly, he wanted to thank Mr. Taylor-Cook for his remarks about the connexion between National Certificate schemes and exemptions from institution examinations. As an L.C.C. employee he must not speak for the L.C.C. but only for himself, but he seriously thought the time had come when the N.C. scheme should be separated completely from the exemptions. The standards demanded by the institutions were rising so steeply that the average student would not reach the requirements if the National Certificate scheme were tied to exemptions. Then the National Certificate scheme would lose its national status, should he say, more because it was too specialized for the institution examination than because it met a local requirement.

MR. TAYLOR-COOK said he agreed with Mr. Howard about the G.C.E. But how often was a principal faced with the statement that the use of the G.C.E. was not to indicate a particular knowledge of a particular subject but to indicate a standard of education! Therefore if a candidate had four subjects, no matter what they were, provided two of them met the requirements, one should be content and take him in. He agreed with Mr. Howard, that whether the principal accepted that or not was within his discretion, but it was the sort of position he was faced with.

As to the comment about the separation of National Certificate schemes from the professional requirement, only that day one of H.M. Inspectors of Education had suggested to him that if the institution demanded 100 hours per subject for an assessed subject in the National Certificate scheme, the Ministry Regulations should also demand that; in other words, that the National Certificate should be matched directly with the institution requirements, and varied with the varying demands of the institution.

His only doubt about Mr. Howard's suggestion for separating them was that if there were a National Certificate scheme and a scheme for corporate membership, nobody would start the S1 and S2 years of the National Certificate scheme if it were stated from the beginning that they would not get corporate membership. They all felt that they could. They had to be convinced by their performance in the course that it was beyond their capabilities before they would lower their sights on to the target that they could achieve.

MR. G. VICTORY (Member) asked whether Mr. Taylor-Cook could clear up a small point about endorsement. It related to people requiring endorsement to different certificates taking the same course.

He had not heard that they took a different examination.

He understood, for example, that an industrial administration endorsement could be obtained on an Ordinary or Higher National Certificate or a Higher National Diploma. All students took the same course but did they sit the same examination?

MR. TAYLOR-COOK said he had not heard of a subject like industrial administration being endorsed on an Ordinary Certificate. The majority of colleges would claim, he thought, that no engineering student was capable of studying industrial administration until he had completed an H.N.C. course. If it was an endorsement either on an H.N.C. or an H.N.D. then it was highly probable that they would take the same examination.

MR. STEWART HOGG, O.B.E. (Member of Council) thanked Mr. Taylor-Cook for his excellent resumé of the National Certificate scheme. In his reply to Professor Chambers he had said something that might be amplified. It might confirm his own thoughts that over 80 per cent of S1 entries failed and did not reach the final examination S3. He would suggest that the whole National Certificate policy should be examined. It seemed to throw on the waste heap a large percentage of S1 entries, most of whom did not attain the standard they might attain in the national interest.

Another point he would like Mr. Taylor-Cook to clarify was why, as a member of the technical sub-committee of the Ministry that decided the question of drawing and heat engineering, he suddenly, twenty-one months later, disagreed with the committee he had supported. He should explain the reasons these decisions were made.

MR. TAYLOR-COOK said he was not sure he agreed completely with Mr. Hogg about S3 drawing for S2. It was his recollection that he had opposed that quite vigorously. The reason for insisting on the existence of an H.N.C. course in the college was to satisfy the authorities that sufficient laboratory equipment was available there.

While agreeing with the necessity for the equipment, he argued that the handling of the matter had been a little heavy handed. The Ministry of Education was, or for some considerable time had been, investigating the laboratory facilities at various colleges recognized for National Certificate schemes and withdrawing approval where the laboratories were not satisfactory. Perhaps Mr. Hogg's views and the views of the Committee of which he himself was a member would help to speed them up and then the Ministry might withdraw the condition.

On wastage from the schemes, the last figures he had—and they were now, perhaps, a little antiquated—were that out of 100 students entering the S1 year of a National Certificate course, about two or three would get through to the final (fifth) year of the H.N.C. Most of this wastage occurred during the first and second years of the O.N.C. course. But so much attention was being paid to the maintenance of standards of entry to S1 in these days that the wastage was likely to fall. In his own opinion, a contributory factor to the wastage had been the way in which the privilege of part-time day release had been extended to all and sundry, whether they earned it or not, and to the insistence of many employers that their apprentices must go into the National Certificate scheme and not into a City and Guilds scheme. If the students were made to earn their privilege of attending a National Certificate scheme, the percentage of failures would drop considerably.

MR. HOGG asked what steps were being taken to persuade employers to direct boys who were not likely to reach the required level into City and Guilds or similar courses, machine shop engineering, and so on. How was this problem being met? He had only heard of one principal in the North who tried to do something, which ended in a Parliamentary question and a rebuke from the Director of Education in the district. He would like to know unofficially what was the policy of the L.C.C.

MR. TAYLOR-COOK said that the L.C.C. encouraged the restriction of the entry to National Certificate courses to those whom there were firm grounds for believing would proceed at least to O.N.C. level. It was difficult to quote specific instances of efforts being made to reduce this wastage; so much depended on the individual college. But so much information was being circulated about wastage, and so many investigations were being carried out into the causes, governing bodies seemed to become infected with the germ and some were insisting on principals producing elaborate analyses of their entries, pass results and so on, and this must have some effect finally. About any organized method of putting this policy into effect, however, he had no information.

MR. HOWARD said there were two forms of wastage. One was due to the student tackling a course and failing the examinations on the way. He did not think this was strictly wastage. They had tried. But there was another form which had not been considered, and this was the evening student, not the day student, who embarked on an N.C. course and left without following it up. This accounted for a very high percentage of the figures included in wastage. He did not see how that could be got round without a crystal ball as college equipment, because it was not possible to decide whether a student would leave the course or not.

MR. T. W. LONGMUIR (Member of Council) said that two points had arisen: wastage and the percentage of passes in S3. It was quite true that the standard of S3 had increased considerably over the last twenty to twenty-five years. The number of hours that a student had to take had not increased, and for quite a number of students if the O.N.C. were four years instead of three they would not give up before the end of the S1 year. He was convinced of that. At least 40 per cent of those who obtained an O.N.C. did take four years. They repeated S2 or S3. If the principals, the Ministry of Education, the Institution of Mechanical Engineers, and the Joint Committee all faced facts and made up a four-year course for O.N.C. the percentage of passes would increase and the number who gave up the course at S1 or S2 level would be reduced.

Wastage, too, depended upon the college. A lot of colleges over the country had to take or wanted to take a certain number of students. Where the number of applicants for a course was perhaps three times the number of vacancies the percentage of failures was very small. But where a college was struggling to get students the percentage of failures was generally much higher.

MR. TAYLOR-COOK said Mr. Longmuir knew very well that he was so potent in his argument about a four-year O.N.C. course that in their mutual history such a scheme was drawn up. He probably thought that he (Mr. Taylor-Cook) was slipping backwards and turning his present college upside down to go back to a three-year scheme when there was a four-year scheme in operation. But he was not convinced now, having tried the four-year scheme, of its value.

Mr. Longmuir had said the number of hours had not increased. For someone who was taking the National Certificate only and had part-time day release, the effective hours had increased. He used to do three evenings each week, possibly of two to two and a half hours and one of two hours, after his day's work. He now had the same length of time, starting fresh in the morning. This was an effective increase in hours.

The reason he was not happy now about the four-year course was in considering the overall length of the course. It was perhaps even more marked in the sort of course with which he was dealing in civil engineering, where the H.N.C. was a minimum of three years. This was an overall course of seven years from the age of sixteen and it was a little too much. Part of the training of a civil engineer was on the site. That was usually done about the age of twenty-one, twenty-two or twenty-three. If the student had not completed his course before he was sent out on the site, the odds were one hundred to one against his finding a suitable college near the site on which he was working. Therefore his studies would at least be interrupted and possibly not resumed. That argument was not so potent in mechanical engineering, because the H.N.C. was a two-year course, but it still represented five years overall as a minimum, originally designed to match five years' apprenticeship. It was vital to shorten the period of apprenticeship, not increase it, cutting it possibly to three years instead of five. Where was the man who could face another three years of technical college study after completing his apprenticeship?

THE CHAIRMAN remarked that Mr. Longmuir had almost answered his own question in saying they took two years for S2 or S3 so that there could be a four-year course.

MR. TAYLOR-COOK said it was not encouraged.

MR. LONGMUIR said it happened but it was not good to stay at one level for two years. With a four-year course, the slope would not be so steep. He had in mind the boy who had not done a three-year course at a good secondary technical school. The emphasis was on the three years and the good school. If he had not done that, he took four years, otherwise, it was three. He thought most people with experience would agree about this.

THE CHAIRMAN asked whether the suggestion was that there should be a preliminary year before the course started to provide the groundwork.

MR. LONGMUIR said that previously students who had not completed a course at a secondary technical school had to pass at J1 or J2 level before attending the technical college; where this was compulsory the percentage of failures on the National Certificate Course was comparatively small. It was where there

was no J1 or J2 and they went into S1 that there was a high percentage of wastage.

MR. TAYLOR-COOK said that in London at least the future was developing on these lines. At one time, for lack of anything better, a college was sorely tempted to admit someone leaving school at fifteen into a National Certificate course. It was very hard to know when these boys whom one was meeting for the first time, came along, desperately keen, whether the reports from their headmasters were worth the paper they were written on unless one knew the headmasters personally. To turn the boys away was very difficult and It was very hard to know when these boys whom one was tempted to admit them at the age of fifteen and turn a blind eye on the regulations.

With the increasing development of the day colleges, as they are called in London, there was a possibility of a preparatory course being arranged under the general supervision of the senior college. That would meet one of the criteria everyone had in mind, but this preparatory course must be a proper one.

At his own college, for example, the whole of S1 had been taken away into one of these day colleges. The courses in the senior college started at S2. All the S1's and the preparatory years were under the same roof, so if a student admitted to S1 were found to be in the wrong group he could be switched over within the same building and very often on the same day. Likewise, if someone in the preparatory course had been put there because his abilities were in doubt he could be switched over to S1 if he proved to be suitable. This was a very valuable development and he hoped it meant that those who had been through the preparatory course and had been successful at the end would help reduce the loss from the S1 year.

MR. L. C. WEEDON, B.Sc.(Eng.) (Member) pointed out that the sandwich scheme, which was growing rapidly, had not been mentioned. This was a little different from part-time day releases in that, instead of attending college one day a week for some thirty or forty weeks, the student went full-time for a period which varied from college to college. It might be six months in and six months out of the factory or it might be much shorter periods. It might be eight weeks in and eight weeks out and another eight weeks back in the college. This would be sixteen weeks' full-time at a college.

He mentioned this because there had been a lot of talk about the connexion between the National Certificate system and the institution requirements for exemption for membership.

The Institution of Electrical Engineers had recently made a statement that might be of importance. They had said quite definitely that they did not expect a student to get associate membership of their institution through the part-time day course. They just did not think it was possible. They expected their corporate members, of course, to come from those who took a course under the sandwich system.

If what they had just heard was true, as he had no doubt it was, the Institution of Mechanical Engineers was probably approaching the same conclusion. The stage, he thought, was being reached where the ordinary lad who went one day a week to a course could not hope to qualify for associate membership. If he did, it was going to take him a very long time. By means of the sandwich scheme it was possible to avoid this situation. He would not go into details. Several schemes, organized by different colleges, were in operation. But in general, to judge by the one he knew at any rate, the percentage of passes was nothing like 50 per cent; he would have thought it nearer 90 to 95 per cent. The student who failed was rather a phenomenon.

He must point out that this was not a miracle. It was done firstly by being very selective with the intake. This had already been mentioned. If the standard of students coming in was sufficiently high, very good results could be obtained, and this tended to happen with sandwich courses. The requirements for entry were put up. The students did not take only National Certificate courses: they took all the endorsements as well. That was to say, they took some six or seven subjects. In this way, they could, in the four or five years of the course, cover what until recently were the full requirements of the institution, including Section C or industrial administration. He agreed that this did not apply to a large number of students. They were not all of the required standard, but those who were would, in the future, he thought, go increasingly into sandwich courses and not into part-time day courses.

He would like to raise two small points. It had been said that people took National Certificate courses who perhaps ought to be in City and Guild courses. There was no doubt that this happened to some extent. Some colleges, he believed, had been running a scheme whereby the first year of their course was common and at the end of the first year the college decided whether the student should carry on with the National Certificate course or the City and Guilds course. In any event his first year had not been wasted. He did not know how far this had been developed; perhaps Mr. Taylor-Cook could say. But it was quite a good scheme to have a common year and divide the courses at the end of the year. The reason was this; it had already been suggested by Mr. Howard that a crystal ball was needed but this was an understatement. One needed more than that, because as far as he knew there were no proved methods of selecting from the intake those who could do the National Certificate type of course and those who could not. It was not uncommon to meet a lad who perhaps did not strike one very forcibly, but in a few years came out top of the class. Reports from schools could sometimes be misleading, to say the least, as Mr. Taylor-Cook had suggested. On this basis, it was not possible to say whether a student should do the National Certificate or City and Guilds course. If he were in the college for a year, one had a chance of finding out something about him, assessing him and ascertaining whether he was likely to make the National Certificate grade or not. Therefore, he would suggest that the scheme of having a year's common course would seem to have certain advantages.

MR. TAYLOR-COOK thanked Mr. Weedon for introducing the topic of sandwich courses. He himself had hesitated whether even diploma courses lay within the scope of his subject, but possibly most people would have heard a good deal about sandwich courses.

Mr. Weedon was very fortunate in the percentage of successes in his sandwich courses. Presumably this was a percentage of the intake who passed the examination.

MR. WEEDON said that was correct.

MR. TAYLOR-COOK said that in the sandwich course at his own college they could not compete with these figures. Including those who were asked to leave during the course because of unsatisfactory progress, he doubted whether the percentage of successes would be much higher than about 75 per cent, even with fairly highly selective entry and quite high educational standards measured in terms of the General Certificate of Education. That would be for a two or three-year sandwich course, leading to a direct exemption from one of the professional institution's examinations.

His only doubt about the sandwich course was one that was often under consideration and was referred to as the "thickness of the sandwich". In other words, was six months continuously in the college followed by six months permanently away from the college the best way of doing it? He would prefer shorter periods, and the eight weeks in and eight weeks out suggested by Mr. Weedon would be a good arrangement, unless the educational authorities would allow the staff time to visit students on the job during their six months away from the college. But for this educational authorities generally would themselves need educating.

As for a common course in the first year, it was his

impression that a first year which was reasonable for a four-year O.N.C. course would not be suitable for a student capable only of doing the first year of a City and Guilds course. The emphasis and speed were quite different.

MR. D. G. ALCOCK (Member of Council) said that some most interesting comments had been made and the discussion had centred round two main themes—entry standard for courses and the demand for professional status. He did not want to start anything controversial but just to state a few simple facts that had come his way over the past six years.

First, young men came from secondary technical schools with qualifications varying between the vaguely "arty, crafty" and, where a school had been closely associated with a major technical institution, a very strong and acceptable degree of scholarship. Of the number of apprentices who had passed through his hands the recruiting had been largely as follows: three grammar school boys to two secondary technical school boys to one from all other sources. In the Ordinary National Diploma course the secondary technical school boys had certainly held their own, even when their entry qualifications had been an S1 exemption, unsupported by G.C.E. (O) subjects, by obtaining a third of the total passes.

As to the new S1 exemption standards, he had carefully examined the past records of his apprentices. The average standard was not less than four subjects at G.C.E. (O) level including mathematics and an acceptable science subject. Only one in seven met the new S1 exemption standards with mathematics, physics and two other subjects. As a matter of interest, no young man who had mathematics and general science failed the Diploma examination.

There seemed to be an indication that these new professional requirements with S1 exemption would require the schools to become preparatory schools for the technical colleges rather than devote themselves to education. Those in general education were fully aware of the difference between a school and a technical college.

In October 1958 he had put thirteen young men on Mr. Weedon's block release course for the H.N.C. If the new S1 exemption standard had been demanded in 1956 when these young men entered the Alternative Training Scheme, five of them would have been considered to be unsuitable.

The selection standard for entry to this course was to have achieved an average of 70 per cent in the examinable subjects of the Ordinary National Diploma. Two of the young men concerned were *ex* secondary modern school boys who took various examinations, including some of the U.E.I. The sole achievement in the G.C.E. (O) of one participant in the course was English Language.

In view of this experience, it would seem that the new S1 exemption requirements imposed a limitation on the number entering the O.N.C. course. Young men passing G.C.E. (O) in mathematics and physics were to be found mostly in the top streams of grammar and good type secondary technical schools. Quite a large number of these young men felt they were of university potential.

He supported the view that these new moves imposed a restriction upon the education of an engineer.

MR. TAYLOR-COOK said he did not suppose he was really expected to answer the last question.

Mr. Alcock had raised one or two extremely interesting points. It would have been noticed that in his own reference to the secondary technical school he had emphasized that he had in mind only the secondary school closely associated with a senior college. Unfortunately, their number was decreasing very rapidly, almost to vanishing point. There was only one in London and it was not intended that it would be there very long.

As to other schools being regarded as preparatory to technical colleges, surely the whole educational system should be planned as a consecutive whole rather than in self-contained parts. If a student was to progress to further education then at least at some stage during his primary and secondary education, it should be slanted in that direction. He definitely should not specialize but it was desirable to have some direction and, far from imposing on the secondary schools, it was something they were seeking eagerly. Many of them felt capable not only of preparing students for S1 but of doing S1 as well. This he did not feel inclined to accept but many of the new large schools in London felt they were capable of doing S1 and if that were accepted they would soon be feeling they could do S2 and S3 as well.

It was not a matter of self-interest when he said he would strongly object to that, not with the idea that students would be lost to the colleges but simply because, at the moment certainly, they had neither the facilities nor the staff to deal with these subjects effectively. And one of the main values of the O.N.C. was that it was taken concurrently with industrial experience. The G.C.E. was not done only at grammar schools. More and more secondary modern schools were entering students for the G.C.E., so one must think not only of the traditional home of the school certificate but of the way it was developing in other schools.

MR. HOGG asked how Mr. Taylor-Cook would advise young men as from 1960 who indicated that they wished to go to sea at 21 when their normal apprenticeship was finished. Would he advise them if they had the capacity, to join the professional stream from S2 onwards, taking a four-year O.N.C. course. The need for the additional subjects would be much greater when nuclear propulsion was introduced and more electronic indicating devices had to be understood.

To amplify what Mr. Alcock had said, would Mr. Taylor-Cook explain the compelling forces driving the three major institutions onwards?

MR. TAYLOR-COOK said Mr. Hogg's question fell into the same category as Mr. Alcock's question: it was the same question in different words. Both questions asked for an expression of opinion on the policy of the major institutions which he was not in a position to give.

As to how the student should be advised, presumably at the age of fifteen or sixteen he had declared his intention to go to sea. One could not give a ruling that would apply to all cases, because so frequently a student who started his training with one job in mind changed his mind later on. When he himself was sixteen he was determined to be an artificer in the Royal Navy but he had never got there: he had changed his objective. He had not been interested in technical education until after he had finished his apprenticeship. He would be inclined to encourage anybody at the age of fifteen or sixteen who was capable of doing it to go for the highest course he could achieve, one which he would complete before entering on his wider career. In other words, if he were capable of doing the complete H.N.C. course plus endorsements he should do it. If he were not, he should not take a course which he would have to abandon when he went to sea at twenty-one; having taken four years over O.N.C. he would only be able to do the first year of H.N.C., and would then leave it in the air.

MR. G. F. GATWARD (Associate Member) asked what were Mr. Taylor-Cook's views on the future of the National Certificate scheme. He had in mind the White Paper published in 1956. From this it would seem that gradually the National Certificate would lose national currency in favour of the Diploma in Technology.

MR. TAYLOR-COOK said there was a vast difference between the standard of the National Certificate and the Diploma in Technology and that they could both exist happily at the same time. The standard of the Diploma in Technology was stated to be equivalent to that of an honours degree, and that was considerably beyond the standard of the National Certificate. There was therefore little likelihood of the National

Certificate scheme being supplanted by the Diploma of Technology.

THE CHAIRMAN said it would be agreed that education was of such vital importance to the welfare of the community that every possible measure which might support it should be encouraged.

Much discussion had taken place about the merits of the National and Higher National Certificate courses. There was no doubt that the certificates were of value in themselves and were accepted as a standard, but the fact that they could suffice, or lead to partial exemption from the qualifying examinations for entry into the professional institutions was an added incentive to those who entered the courses.

They thanked Mr. Taylor-Cook for a most interesting discussion and for the way he had answered the questions put to him. Thanks were also due to those who had taken part in the discussion.

INSTITUTE ACTIVITIES

Section Meeting

West Midlands

At a meeting of the West Midlands Section held at the Engineering Centre, Stephenson Place, Birmingham, on Thursday, 26th November 1959, Mr. R. R. Gilchrist, M.A. (Associate Member) presented an illustrated lecture entitled "The Manufacture of Thick Walled Tubes". There were thirty-five members and guests present and the Chair was taken by Mr. R. S. Robinson, B.Sc. (Chairman of the Section).

Mr. Gilchrist gave a brief review of the history of the tube industry, describing the earliest invention for the piercing of billets. The same principle is still used today and a most interesting demonstration was given with a working model which pierced plasticine "billets".

With the aid of lantern slides the latest methods of tube manufacture were described, and the advantages and disadvantages of each were considered.

In conclusion, Mr. Gilchrist explained the inspection and testing required to maintain the highest quality with a high rate of production.

The Chairman thanked the author on behalf of all those present for a most interesting lecture and for answering so fully the five questions which were put to him.

The meeting closed at 9.0 p.m.

Student Section

A meeting of the Student Section was held at the Memorial Building, 76 Mark Lane, London, E.C.3, on Monday, 7th December 1959 at 6.30 p.m., when a lecture entitled "The Closed Feed System" was given by T. O. Leith (Graduate). The lecture was followed by a lively discussion period.

Mr. R. S. Brett (Associate Member) was in the Chair and twenty-five members and visitors were present.

A vote of thanks to Mr. Leith, proposed by the Chairman, was carried by acclamation.

The meeting ended at 8.15 p.m.

Election of Members

2nd November 1959

Stanley John Bellamy was elected a Companion of the Institute at the Council Meeting held on 2nd November 1959.

14th December 1959

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Peter Betteridge
Harry Bevis
John Francis Butler, M.A.(Cantab.)
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Thomas Coey
Robert William Davies
Abdel Salam Dawood
George Allan Campbell Dun
Thomas Richard Evans
Harold John Feickert
John William Hickling
L. Arnold Johnson, O.B.E.
Cyril Charles Lawrence
Otto Francis McMahon
William Sweyn Macqueen
Per Viggo Meulengracht
Geoffrey Forster Oliver, B.Sc.(Durham)
Eric Harold Otten, Lieut. Cdr., R.N.
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Godfrey Frederic Redfearn
Robert Scarth Smith
Cecil Strain
Alfred Robert James Strickland, Lieut. Cdr., R.N.
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Malcolm Cumming Wilson
William James Wright

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Donald Cormack
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John Michael Foottit
Brij Raj Kishore Gupta
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Albert McFall
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Allada Somalingeswara Rao
Vernon Charles Ridge
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Malcolm Hunter Tait
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Mian Hamid Aziz
John Francis Bardsley
David Harrold Blenkinsop
Maurice John Bullock
Patrick Byrne
Allan Crowther
Ronald Ellison
Samuel George Flanagan
John Andrew Gibb
James Colin Hatchman
Colin John Kingston Heaton
Mansel Emlyn Hopkins
Clive David George Jenkins
Gordon John Knight
Iain James Macdonald
William Nicol McIlvean
Gopalrao Madhavan
Paul Malley
Henry Merryweather
James Richard Mitchell
Norman Leslie Pallin
Charles Malcolm Parry
Simon Charles Rayfield
James Gordon Scott
Frederick Richard Southam
Marcus John Stocks
Alan Wakefield
Michael Anthony Ward
James Weedon
Colin Adrian Weston
Anthony David Frederick Wilson

PROBATIONER STUDENTS

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Ian Michael Anderson
Peter Thomas Attenborough
Lewis Lonsdale Bamforth
Geoffrey Baxter
Roger Joseph Bedson
Kenneth James Begg
Michael George Peter Betts
Hugh Wilson Binnie
Allan Smith Blackwood
Jeffrey Walter Booker
Leslie Mathew Fitzgibbons Boyle
Ivor Barry Capstick
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Michael John Randall Westoby
David Weston
Graham Albert Winstanley
John Woodruff
Frank Robert Kenneth Wright

TRANSFER FROM ASSOCIATE MEMBER TO MEMBER

Raymond Earl
Walter Logan Howey
Norman Joseph Myers
David Nicholl Ormond
Henry Paton

TRANSFER FROM ASSOCIATE TO ASSOCIATE MEMBER

Conway James Beamish
Wilson Matthew Broomfield
John Rosman Hull

TRANSFER FROM GRADUATE TO MEMBER

John William Rose

TRANSFER FROM GRADUATE TO ASSOCIATE MEMBER

William Howson Backhouse
Tara Charan Banerjee
Charles Cairns
Roger Hewson Harvey
Graham Hawes
Philip Granger Hoggarth
Lionel Arthur Jones
Allen William Lawrence
Leo Mario Mussi
Derrick Frederick Streeton

TRANSFER FROM STUDENT TO GRADUATE

Gerald David Ashley
Ian Bennett
Martin Redfern Hankey
James Wilson Johnston
Norman Herbert McConochie

TRANSFER FROM PROBATIONER STUDENT TO STUDENT

Gilbert Rudolph Henderson

OBITUARY

ALFRED J. BUCHI (Member 7090), chairman of the board of Dr. Alfred J. Büchi Limited, Winterthur, Switzerland, died in October 1959 at the age of eighty, following a brief illness.

After attending school in Winterthur he was apprenticed to Sulzer Brothers before taking a course on mechanical engineering at the Swiss Federal Institute of Technology from 1899/1903. He completed his diploma studies with distinction under Professor Dr. A. Stodola, who was a great stimulus to Dr. Büchi in his own research. From 1903/06 he worked in the Ateliers Carels Frères in Gand on the problems raised by the development of the Diesel engine, and later on a study tour in England. By 1905 he had filed patents for his design of an exhaust gas turbocharging system which was the forerunner of the modern counterpart, incorporating a multistage axial compressor and a multistage gas turbine. He returned to Sulzer Brothers in 1909 as chief engineer and head of the Diesel research department and there he set up an experimental exhaust gas turbocharged Diesel engine.

The first world war interfered with this research and when it was over there was a general unwillingness to depart from the traditional design of Diesel engines. With a view to developing exhaust type turbocharging on a broader basis the Büchi Syndicate was founded in 1926 with the inventor, the Swiss Locomotive and Machine Works in Winterthur, and Brown, Boveri and Co. of Baden, as partners. In addition, Dr. Büchi was entrusted with the technical management of the Swiss Locomotive Works from 1928/35. From this time onwards the Büchi system was freely adopted on the Continent and in Britain and later in the U.S.A. and Japan.

The inventor contributed two papers to the Institute, in 1928 and 1933 respectively, entitled "Turbocharging of Internal Combustion Engines, especially Diesel Engines", and "A Comparison of Supercharging Systems for Marine Diesel Engines". He was elected a Member of the Institute in 1932. In recognition of his services in the development of the exhaust turbocharger, the American Society of Mechanical Engineers in New York awarded him the Melville Medal in 1937. In 1938 the Swiss Federal Institute of Technology conferred on him an honorary doctorate of engineering.

RONALD VALLANCE CAMERON (Member 3486) died in January 1955. He completed an apprenticeship with Mechans Ltd., Scotstoun, Glasgow, in 1908 and remained with them until he went to Hong Kong in 1911 to seek employment on the China Coast. He joined the China Navigation Co. Ltd. as a seagoing engineer in the same year and remained with the company until he retired in 1947 as senior assistant superintendent engineer. His first ship was the *Tamsui* which he joined at Amoy in April 1911 and he spent four years at sea between China Coast ports. He obtained a First Class Board of Trade Certificate in 1914 and came ashore the following year, being appointed an assistant superintendent engineer in 1918, at which time he was elected a Member of the Institute.

After standing by the *Kweiyang* under construction at Greenock in 1921, he returned in her to Hong Kong. Periods at Hong Kong and Shanghai as assistant superintendent engineer followed and he was superintendent at Hankow from 1930/32 and at Shanghai from 1938/41. During these years he was concerned with the construction of several coasters and river boats as well as being responsible for salvage operations which became necessary as a result of typhoons.

During the second world war, from 1941/45, when ships were based on the Indian Coast, Mr. Cameron was superintendent engineer at Calcutta and Bombay. He gave considerable assistance during the salvage operations following the Bombay explosion of 1944.

Upon his return to the United Kingdom in 1947 he became overseer for the company's new construction and retired finally in 1951 when their immediate post-war building programme was complete.

JOHN HODGSON KIRBY (Associate Member 9023) was born at Preston in 1910 and was educated at the Harris Institute, Preston, and then at Liverpool. He served an apprenticeship with Preston Corporation from 1925/32 before going to sea with the New Zealand Shipping Co. Ltd. He obtained an Extra First Class Board of Trade Certificate in 1938.

In 1939 he joined Grayson, Rollo and Clover Docks Ltd. as assistant manager and from 1944/46 he was an engineer and ship surveyor at Liverpool for the Ministry of War Transport. He then joined Smith's Dock as engineer manager, became yard manager in 1952 and two years later was appointed general manager. He left that company in July 1957 to become general manager of the Manchester Dry Docks Co. Ltd., and in January 1958 was elected to the board of directors. He was appointed managing director on 1st November 1958.

Mr. Kirby joined the Institute as an Associate Member in 1939 and served as a member of committee of the North East Coast Section from 1954/56. He was a Member of the Institution of Mechanical Engineers. In November 1958 he was appointed a member of the Central Board and the Conference and Works Board of the Shipbuilding Employers' Federation and was a member of the Executive Committee of the Dry Dock Owners' and Repairers' Central Council.

JAMES STURROCK WALLACE (Member 4322) served a five-year apprenticeship to engineering with Grant Ritchie and Co. Ltd. of Kilmarnock. He joined the Elder Dempster Lines as a junior seagoing engineer in 1909 and was appointed to the s.s. *Mende*. He obtained a First Class Board of Trade Steam Certificate in 1912. He was promoted second engineer in August 1914 and sailed in the s.s. *Appam* until October 1915, when he joined the army. During his war service he attained the rank of Captain in the Corps of Royal Engineers.

Mr. Wallace was demobilized in November 1919 and rejoined the Elder Dempster Lines as a second engineer, being promoted chief engineer a few months later. He was elected to Membership of the Institute in 1921. In 1927 he served in the company's motor vessels and obtained a Motor Endorsement to his First Class Certificate. He continued to serve the company as chief engineer until his retirement as a result of ill health in October 1949. During the second world war, while serving as chief engineer of the *Edward Blyden* in 1944, the ship was sunk, but Mr. Wallace suffered no ill effects and was sailing in another vessel two months later. The last ship in which he sailed was the *Tarkwa*. He died on 3rd November 1959.

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