

DISCUSSION CONTINUED

ON

MONDAY, FEBRUARY 13th, 1899.

CHAIRMAN:

MR. A. BOYLE (MEMBER).

THE CHAIRMAN: I had no idea that I should have the honour of being asked to take the chair this evening, and you must therefore pardon my imperfections, as I am not familiar with the routine of the meetings. But as I am very earnest in the desire to do anything I can for the Institute, I can only hope that you will kindly overlook any omissions on my part. The business this evening is to resume the discussion on "The Marine Engineer."

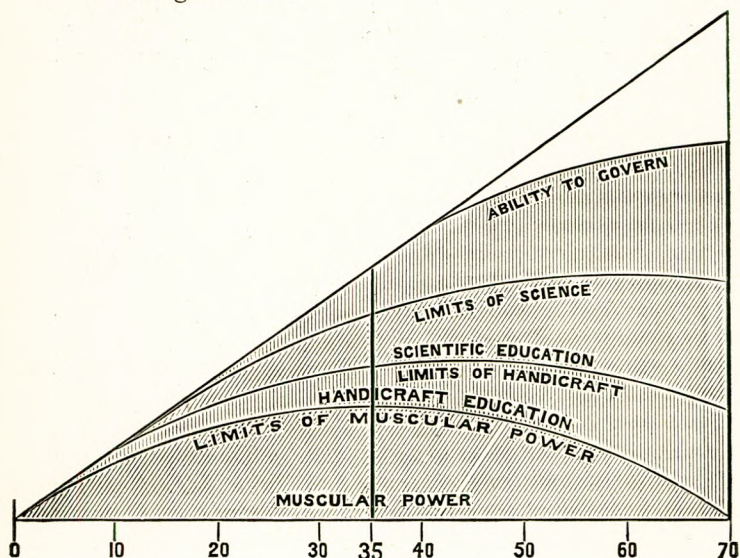
MR. J. R. RUTHVEN: This paper is one of the most important brought before the Institute, and when it was read I wrote a few remarks upon it, feeling great interest in the subject. But since then Dr. Inglis has delivered his presidential address, which gives expression to certain thoughts, and if I happen to say anything similar to what fell from him, it is not because I have copied him, but because we happen to have thought on similar ideas. Above marine engineering and the making of machines stands the marine engineer, the man and his training. The round man in the round hole, and the square man in the square hole, would be the perfection of education. In all education we run the risk of educating the head at the expense of other abilities—the head too much and the hands too little. Education should be thorough. It is a serious question to ask whether a good workman, or one who promises to be one, may not direct his attention from his tools, and make little headway in science. The object of education should be the greatest usefulness at the least cost. This can only be done by each man being educated

for a purpose, so that he can fill a certain situation. One man of ability to direct well, and many men of muscle to work well, are better than a gang of men each of high attainments. A little knowledge is a dangerous thing. It has been said that half a loaf is better than no bread. To a nation this is not true; two half-starved men are not better than one properly fed. It is a serious thing to experiment in education; means should be taken to make the best of each one's capabilities. There is a suspicion that the technical institutes are not making better workmen. There is something else wanting than the present facilities for attending evening classes.

The modern treatment of apprentices is a great evil. The old system should be revived, and an earlier age of beginning—I think fourteen years of age quite late enough for a boy to start work; but for several years I would propose short work hours and time given to study in the day time. The technical schools could in this way do much better work than now appears to be done. Work while it is day. Night work is not good for growing lads, and takes them away from the home influence. Every healthy boy enjoys work; but it must be useful work. With regard to the five years' apprenticeship, if the employers connected with the Institute would only favour men who had served five years, it would soon become more general. Regarding the third class certificate, something might be done by the Institute empowering a competent engineer to examine young engineers and grant a certificate which could be recognised by the employers in sympathy with the Institute and its endeavours to raise the status of the marine engineer. It is surprising to note the number of successful men who have started their life work early and with little education, and the number who have studied at school to a late age and become commercial failures. Then there is the genius. What will you do with him? I suppose you will leave him to educate himself as has been done before. It is said

that Edison remarked that had he had an electrical education he could not have invented the wonderful machines which he has done. You run the risk of throttling genius ; you push the genius out as you push other matter in.

Mr. RUTHVEN then sketched the accompanying "human diagram" on the black board, and, explaining its meaning, he said :



The horizontal line represents the length of a man's life. The vertical distances to the curved lines represent a man's ability, wealth-producing power, or wages. The first curve will indicate the growth of muscle and its decline. The second line added above the first indicates the increase of value due to technical handicraft, or the knowledge and method of work, directing the muscular energy. The next line added represents the additions to a man's powers by a know-

ledge of science. The fourth, or last line, represents the added power of the ability to direct or govern.

The first line may represent the power of the simple man; the second the compound man; the third the triple man, and the fourth the quadruple man. There seem to be many opportunities to be taught in every department but the last. Administrative ability is not taught; why is this? It is more important to a man than all the others put together. What is our object in burning the midnight oil, that is, in study? Is it to enjoy knowledge or to make more money? The first object is certain, the second is doubtful; and I would advise all to go in for study for the pleasure of knowledge, but only where they are inclined and for the special class of study they affect. But you will say all education is to enable a man to win in the race for life. There are two ways of winning a race—one is to go ahead by one's superiority, this creates wealth; the other way is by hindering our neighbours. This Institute was founded to help on the wealth and power of the nation by enabling marine engineers to meet and discuss various matters connected with their daily business. The Council is always willing to give advice to young men on the course of education.

Mr. G. HALLIDAY (Member): The diagram submitted by Mr. Ruthven is very interesting, but it commences at a zero line, and when we consider the expense borne by the parents before a lad begins to earn a wage, which, I take it from Mr. Ruthven's explanation, starts at the zero line, we must run some distance below this, as there are arrears to work off, such as the cost of preliminary training, etc. The curve therefore should extend below zero to cover liabilities before wage earning begins.

Mr. W. LAWRIE (Member): The author of this very interesting paper has fully discussed the training requisite for the young marine engineer, and, speaking

in general terms, I may say that I agree with the thoughts and ideas which he has put forward for our consideration. On the last pages of the paper the writer gives us some idea of the duties and responsibilities of a chief engineer, and as that is the goal—perhaps not the final one—of the young marine engineer, we may with advantage look a little more closely into the duties and responsibilities attaching to that position. In the first place the marine engineer has under his charge a very valuable property, and as the machinery and boilers develop and utilise the motive power of the vessel the modern steamship would be practically useless without them. Therefore they require ceaseless care and attention on the part of the engineer. The machinery is a very finely balanced piece of mechanism requiring careful adjustment, and the boilers are subject to some very destructive agents. Therefore I consider that the marine engineer must be something more than a good mechanic. If he is to be successful he must know the exact relation of one part of the engines to every other part, and he ought to know the reasons for the design and construction, as well as the general working of the machinery. He has also in his charge the fuel of the vessel, which in all cases is a very important part of the economy of the vessel, and the engineer should know what becomes of it from the time it is put into the furnace until it leaves the ship in the form of propelling power. Looking at these duties and responsibilities, I think the author is justified in the statement he makes in the third paragraph. He says: "As it is necessary that the mind should be trained to investigate and draw conclusions on which action depends, the essential course of study must be directed to the exact sciences—mathematics, physics, chemistry and geology being given prominence to." Again, he says: "With the increasing introduction of so much auxiliary machinery and so many appliances for saving fuel and economising perishable stores, the duties and responsibilities

of the chief engineer have been largely increased, not only in the large liner but in the ordinary cargo steamer. This has become a truism, acknowledged and appreciated, and as time goes on it will be so more and more. The writing and reading of papers and taking part in the discussion of subjects of a commercial as well as of a technical character all tend to the general good and improvement; such should therefore form a part of the duty which an engineer of experience owes to his fellows and his country."

That paragraph reminds me of a leaderette I saw in the *Chronicle* a few weeks ago. Lord Rosebery had been making a speech in Edinburgh, and he had been claiming for his country north of the Tweed a very large share in the work of empire building. The writer of the article repeated the very familiar story that if you called out "Mac" on board ship somewhere in the vicinity of the engine-room skylight you would be certain of a response; but the writer further said that while Lord Rosebery, on the one hand, was an example of a Scotchman who had become conspicuous in a lofty station in the world, so in a humble station was the example of the engineer cited, i.e., "the man who carries the oil-can round the thundering machinery, and the man who holds the helm of the ship of State, serve alike the national welfare, and bear the burden of the national ideal, and both men, let us gratefully remember, are very often Scotchmen."

It seems to me that when an enlightened newspaper gives voice to such a remark as that about the marine engineer it is time he knew something about it. Then, as you know, it is also necessary for a chief engineer to have some knowledge of electricity; and if he is up to date he must know something about refrigerating machinery. Then there is the steam steering gear, and the heating and cooking machinery, nor should we forget that he is responsible for keeping the vessel clear of water—a most important duty—a little neglect

of which may mean the loss of part of the cargo, and in an extreme case even the loss of the ship itself. The presidential address has quickened our interest in this paper, as Dr. Inglis suggested that probably the German drill sergeant had some beneficial effect on the youth of that country, and that some of our apprentices would be the better for a similar course of treatment as a means of instilling into their minds some respect for law and order. Considering the multifarious duties already imposed on our marine engineers and the years necessary for acquiring a knowledge of the same, I confess I am at a loss to understand where the necessary time for acquiring a knowledge of soldiering is to come into their education. I have no hesitation in saying that their time is now fully occupied, and further that the habits learned in the army are not beneficial to young men, but very much the reverse. The author of the paper is, I think, quite right when he says: "So the guardian of the future marine engineer has to consider the course of training necessary to qualify his charge for taking a place in the world with credit to himself and satisfaction to all concerned." The home training of the youth, before he enters the workshop at all, should be directed towards strengthening his moral qualities, and I use the word in its widest sense, because I consider that it is immoral for a youth to scamp or evade his work, and I feel certain that our lads at home should be taught to be straightforward and honest. This brings me to the atmosphere of the workshop. The paper deals fully with the labour the youth will be called upon to perform, and gives him some excellent advice about some things he ought to avoid, such as shoddy work, etc., and the first paragraph on page 12 ends with an admonition, which old and young will do well to remember. "It is none the less a matter of duty and common honesty that each one should do his best." Now I feel that I am getting on to rather thin ice, which the author has studiously avoided—perhaps wisely so. Our up-to-

date trade unionist abhors either the man or the youth who turns out a good day's work. I consider it is his duty to do the most that one can reasonably do, quite irrespective of what others may be doing, and in that I am opposed to the trade union policy of "ca' canny," which is so harmful to the young man who listens to it. When trade union members condescend to spy on their fellow-workmen and report them when they think that too much work is being done, we can understand what their influence will be on the apprentice. It is an evil influence, and should be resisted by every right thinking man. I could say more on this point, but having entered my protest I will leave it. I have often thought that the apprentice does not always get the amount of training he needs, especially in our large workshops, when the foreman has very often quite enough to do in supervising the work in hand without giving the apprentice any special attention. I think it would be a better plan if a special working foreman were appointed, where the number of lads would admit of it, whose business it would be to see that they had plenty of work, and instruct them how to go about it in an orderly and methodical manner. Our apprentices, and also our marine engineers, ought never to be without a pocket-book; they should make rough sketches as they go along, elaborating them at leisure, but always carefully noting dimensions. The young man would find such a book invaluable in after years. There is just one other matter that I should like to refer to very briefly, and that is the communication we heard read at our last meeting from Sir John Durston. Personally, I was under the impression that anything which emanated from a Government dockyard, however good it might be, was certain to be smothered by being tied up in miles of red tape. This communication from Sir John Durston has dispelled that idea so far as the engineers in the Royal Navy are concerned. I confess to a great deal of pleasure in finding that the train-

ing of the young engineer for the Navy is directed on the most progressive lines. I also note what Sir John tells us, that the marine engineer who enters the Navy from a private establishment very soon adapts himself to the routine and discipline of the Navy. It would be valuable information if we could learn what is considered the weak points in the training of those young men who come into the Navy from outside, and what are the strong points. Regarding these instructional classes referred to in Sir John Durston's communication, I happened to be speaking recently to a mercantile marine engineer who had gone through a full course, and he told me that it was a most instructive experience for him. I asked him if he had any fault to find, and he said "No," but he thought the time given was rather short, and that for the many phases of naval life more time was desirable. I also asked him how he got on with the naval engineer officers, and he told me they had received him in a most gentlemanly and brotherly spirit—that they had exerted themselves in every way to show him every courtesy and privilege it was in their power to show him. That is an excellent spirit, and one that will work beneficially to everyone concerned. It will be good for the mercantile marine and good for the Royal Navy—good for all parties.

Mr. A. MATHER (Member): I had no idea of taking part in the discussion to-night, but there are one or two points which have been raised in the course of the discussion to which I may perhaps be allowed to refer. Dealing with the question of a third grade certificate for engineers, Mr. Halliday suggested that an examination for such a certificate might be undertaken by this Institute, and that there should be money prizes for those who thus passed for a certificate of a lower grade than that given by the Board of Trade. I do not think that the giving of money prizes would be any advantage. The prize should be a better chance of getting away in a ship, which would be much more valuable to a

young man than a money prize. With regard to the training of engineers for the Navy and the experience to be gained by actual service in the ships of the Navy, there can be no doubt that a great many engineers in the merchant service have not the faintest idea of what the work is like in the engine room of a modern warship. The high pressures, the high piston speeds and other conditions of work are so altogether different from the ordinary practice in the mercantile marine, that even a short period of training under naval service conditions is a valuable training for an engineer. At the same time I think that a longer training than is now given would be desirable.

Mr. W. McLAREN (Member): Apprentices should be allowed facilities for study in the day time. I must confess that in the first year of a lad's apprenticeship the employer loses a great deal. At the same time there are establishments like Richardson's at West Hartlepool, where the apprentices have every opportunity and facility for learning their trade. Indeed, when I was at Richardson's, nearly all the leading hands were men who had been apprenticed to the firm. I deprecate the introduction of trade unionism into the discussions of the Institute, but while I am strongly opposed to those socialistic ideas so often promulgated among workmen, I think that employers are sometimes to blame for much that is attributed to trade unionism.

Mr. R. DUNCAN (Member): On the sixth page of the paper the author refers to a remark by Sir Thomas Lipton, to the effect that success in life lies in taking advantage of the opportunities which come in one's way, and he says it is not given to everyone to know the opportunities when they do come. But in engineering there is something besides that which influences success or non-success. The bulk of engineers are fairly well educated, but there is one part of their education which is neglected, and that is the application of knowledge to practical work. You have no doubt come across men who have gone through the

colleges and taken high degrees in technical education, but who have not the power to apply that education to the practical work of life. It is very strange, but you see it every day in engineering life. It is a great mistake to cram a man's head full of technical knowledge, without giving him the slightest instruction how to apply that knowledge to the work of every-day life. If some system could be arranged by which that technical knowledge could be rendered available for application to the practical work of the workshop, it would be a great advantage. At present that part of the man's education seems to be left out.

The HON. SECRETARY: In a letter just received, one member writes to me as follows: "I should like to refer, in connection with the discussion due on Monday, to the present state of affairs in the Navy, with respect to its engineering department. Can we view without concern the huge battleships and cruisers now rapidly accumulating for the Navy, and the limited and subordinate position given to the engineers, and with which they are expected to maintain discipline over the large and ever increasing number of men forming their staff—an organisation which may have been suited to the days when steam was considered as an auxiliary to sail power, but absolutely unsuited to the needs of the present day? The prominent part played in the Spanish-American war by the engineers of the United States navy, as evidenced in the very noteworthy voyage of the *Oregon*, is worthy of record as the finest steaming performance made by any battleship. Note also the state of affairs at the battle of Santiago, when Cervera's fleet was destroyed, as depicted in the *Engineering Magazine* of January, 1899, when, instead of what happened, if the Spanish fleet had possessed efficient engineering staffs, these ships should have made a good fight, being initially faster ships than the Americans, and catching them unprepared as they were. It might even have happened that one or two would

have got clean away, and then what a scare there would have been on the Atlantic seaboard of the United States! Commodore Melville's report to the Secretary of the United States navy after the war is an important paper, as in describing the condition of some of the vessels, he says: 'The machinery of some . . . can only be described as horrible,' a condition of affairs due primarily 'to the absence of trained engineering supervision.' In view of the foregoing, we have the fact that the United States House of Representatives has just passed, without dissent, the bill for the re-organisation of the *personnel* of the United States navy. Without giving any definite opinion as to the advisability of this solution of the difficulty, there is still sufficient to show that the need for re-organisation has been realised; the question naturally here arises, are our own naval authorities giving the attention to this subject that its importance demands, and is the organisation of the engineering department of the Royal Navy, considered by those in a position best able to judge, conducted on a system fitted to stand the strain which it must be subjected to during active service? The answer to this last question appears to me to be 'No.' I have heard of a well-known Admiral who made use of the expression, 'We must keep these people down.' This was with reference to a question of cabin accommodation, where the senior engineer had been given a cabin on the main deck, but the Admiral considered this too good for an engineer, and so he was relegated to a deck below, where he would on rare occasions, perhaps, be able to get a little light and air when he was relieved from his many onerous duties. In view of Commodore Melville's remarks on 'the absence of trained engineering supervision,' rumours are heard that the Admiralty are now placing machinery in the hands of officers who have had no engineering training. Remarks are also made that endeavours are being made to constitute an amateur engineering branch, thus apparently

minimising the importance of the engineering officer. The condition of things seems far from satisfactory as regards the engineers. The position and authority of the Engineer-in-chief are well known, but there is very little doubt that if he represented his department on the Admiralty Board, as you have advocated on several occasions, many of the blunders which have been perpetrated and many of the grievances would have long since been remedied. From inquiries I have made I find there are now about one hundred engineers doing the duty of chief engineer without the pay or time of the senior rank being given to them to compensate them. This is a temporary expedient which has been in existence for about nine years. This proves that the chief engineers' list is too small and should be largely increased. An engineer officer has to wait for eleven years, I gather from what I have searched in the papers and articles on the subject, before he can receive the same rate of pay a surgeon does on entry, and yet his training is not less costly. As regards rank, too, a chief engineer has to wait four years before he is allowed to rank directly with a lieutenant of eight years, though he will then be forty years of age while the lieutenant will be only thirty-one; his rank, then is of course only relative, which really means nothing at all. The burning question of control of his own men is one that appears to me should be dealt with immediately, as at present he has to perform duties without the rank and authority to compel them being properly carried out."

The HON. SECRETARY: With reference to Mr. Ruthven's objection to apprentices attending classes in the evening, I believe there are some workshops where apprentices are allowed to attend classes during the day time, but I fancy that very few employers will care about letting out their apprentices during the day for this purpose.

Mr. RUTHVEN : The employers should be compensated for it.

A MEMBER : Where is the compensation to come from ?

Mr. RUTHVEN : From the national point of view it should be the object to get the best possible results from the apprentices. If it is a desirable thing to do, it can be done. The question we have to thrash out is this : Is it desirable that the boys should work during the day only ? I think it is.

Mr. C. NOBLE (Member of Council) : The engineer students at Keyham get to themselves, I think, three afternoons and three evenings each week.

Mr. MCLAREN : Arrangements should be made for the apprentices to go to classes in the day time.

Mr. LAWRIE : Would you propose to apply that arrangement to apprentices in all trades ?

Mr. MCLAREN : No, only to marine engineers.

Mr. DUNCAN : The best plan is to give six months in the year in a workshop and six months in a college. You cannot disorganise a whole workshop by sending out a few apprentices for a part of each day.

Mr. COOK : I confess I do not see how this idea of Mr. McLaren's is going to work out. It seems to me that the young men of the present day have very much better opportunities for improving their minds and gaining knowledge than we had in our youth. In every respect they have much greater facilities for improving and extending their knowledge on almost every subject of education than were available in years gone by.

Mr. LAWRIE: The more opportunities you give some men the less they will make use of them.

Mr. McLAREN: It is very sad to see so many young men hanging round street corners when there are so many libraries, technical institutes and other places ready to receive them and give them valuable knowledge.

The CHAIRMAN: We have had a very interesting and instructive discussion to-night, and I have enjoyed it very much. First of all there is the diagram which Mr. Ruthven has given us, and we might occupy a whole evening in examining and amplifying it. Various points have been dealt with, indeed the subject is one in which the whole of marine engineering is bound up, and it is absolutely inexhaustible. There are one or two thoughts that have crossed my mind in regard to the education of young engineers; and if we confine ourselves to the engineering education I hold that the foundation must be a mechanical education—that is, not only an education of the head, but an education of the hands. While Mr. Duncan was speaking—and with the spirit of his remarks I entirely agree—the thought just occurred to me that he did not carry his observations to their logical conclusion. He did not say how he would suggest the practical application of this technical knowledge. He seemed to leave it to a matter of natural aptitude. It is perfectly true that the natural aptitude of one man is greatly superior to that of many other men, but for all that it is astonishing how much good work is done by imperfect men—by men not of the highest ability. It is not everybody who has got that power of thinking promptly—that keen perception of what is best to be done in any engineering difficulty; but at the same time there are qualities which are, so to speak, the natural birthright of all, and those qualities can be cultivated. It is astonishing what, by application, can be brought out from a man who is in no way superior to his fellows. You know the old proverb that while

you may take a horse to the water it is impossible to make him drink ; and so it is with young men, but that is no reason why the opportunity should not be given to them. We cannot compel young men to devote their evenings to study. I entirely agree with what has been said by Mr. Cook as to the extraordinary increase in the opportunities for acquiring knowledge of all kinds, as compared with those available twenty or thirty years ago, and those who make good use of these improved opportunities will rise in their profession. I do not know that I can say anything further. I can only say again that I am extremely pleased to be here, and that I am very glad indeed to do anything I can for the advantage of the Institute of Marine Engineers. Speaking about education, I always thought that education, to a certain extent, was a sharpening of the tools. It is an important part of a man's work to sharpen his tools, but a man who spends the whole day in sharpening his tools is of little more use to his employer than the man with no tools at all.

The meeting closed with the usual votes of thanks.

The HON. SECRETARY : By request I add a few lines of comment on the discussion which has taken place, on changes which are impending, and on matters which have been brought forward into considerable prominence since the paper was read. Reference was made by Mr. Smith to the handling of men and the tact necessary to make all things work in harmony ; this is an important factor in the economy of the engine-room and has been remarked upon by several members, who have pointed out that the chief engineer should have the exercise of more control and jurisdiction over the men in his own department than is allowed either in the navy or the mercantile marine by present usage. In all well-regulated steamers, by the exercise of tact and that sympathy which ought to

exist between the executive and the engine department, due to the bond of union in the common interest, there is harmony; it is when, by the exercise of irritating interferences and the petty annoyances due to small-mindedness, the course fails to run smooth, that natural distrust and suspicion is engendered and the position becomes unsatisfactory to everyone concerned. There must be one in supreme command, but granting this, it remains that the supremacy should be exercised with due regard to the conditions under which responsible subordinates have to carry on their duties; and it would appear from the extensive communications which have been published lately in the various journals, that in the navy, at least, it has been found in practice necessary to appeal for a revision of the regulations in order to give the engineers a better opportunity of carrying on the work in their department more efficiently, more thoroughly, and more economically. Such a consummation taxpayers should, and engineers will, agree in hoping for. In most cases where irritation and a disjoining of interests are met the evil is due to a medium, reminding one of Carlyle's pictures in *Sartor Resartus*; the effect is not only discord, but the further-reaching wave of disturbance which provokes change and new regulations for the setting of bounds. The proposed alterations in the regulations for engineers before obtaining Board of Trade certificates are at length being formulated, and the workshop service fixed at five years in place of three years' minimum as formerly; there are alterations in several of the details, but the proposed third grade certificate does not appear to be included in the programme, as, in our opinion, it should be. We may consider the subject later on when it comes before us to express an opinion upon.

The experience of engineers in tramp steamers has been referred to. The conditions under which the machinery is worked in many of these would form an extremely interesting subject for discussion, while a

record of the difficulties and troubles experienced would be most edifying and educational if placed before us. It is hoped that some member may give a paper founded upon life in the engine-room of a tramp.

Mr. Ruthven indicated a thought towards creating specialists in the engine-room to take charge of the different types of machines, or to deal with different classes of work. Such a view does not seem to me to be in the right direction; rather let the juniors be encouraged to study the different types and become acquainted with the detailed working of each and all of the machines. Experience can only come by close contact with the working of machinery. Rudyard Kipling has well expressed the sense of this in his own terse way, and the consequences likely to ensue when the experience is gained by adverse circumstances culminating in a breakdown or a burst steam-pipe. I specially refer to the articles which lately appeared in the *Morning Post* from his pen.

It has frequently been urged here that the process of education should be for the purpose of developing and training the mind, and that not with the view of transforming those who are undergoing the process into mere money-making machines, as are the Strasburg geese by the process of stuffing. Mr. Scarth, Mr. Dobbie, and others have again emphasised this, and urged the duty of the Institute in helping on the process of developing, as against that of cramming, the mind; the former tends to the improvement of the whole race, mentally and physically, and prevents many of the evils which are involved in the latter. At our discussions, and in our work in connection with the Institute, it is advocated that everyone who seeks to improve his mind will find a means of educational advancement by taking part. Our President in his admirable address has dealt with several points in connection with general and technical education, which

strengthen the case of those who have advocated the better system and are opposed to that of the penny-pie theory, born since the inauguration of the School Board and competitive result payments.

The references made by Mr. Halliday and others to James Watt, of illustrious memory, recall the story of his life, and the address given by the President of the Institution of Engineers and Shipbuilders (Scotland) at the James Watt dinner, held in Glasgow in January, the report of which appears in the February journals, and is worthy of perusal. Prejudice and narrow-mindedness are enemies to progress in some directions, but not infrequently the very obstacles placed in the way become as mirrors to reflect the greater glory of discovery and forward progress. Comment has been made on the policy of a certain class of trade unionist, whose view of life is limited by a very narrow-minded idea of duty. I agree with Mr. Lawrie most cordially in his remarks on the subject, these being an endorsement of previous words in a lecture delivered to the graduate section about three years ago. The shirking of duty and idling of time cannot be defended on any ground, and while, as Mr. Lawrie says, I avoided dealing with this aspect of the question, I did so because it was not quite pertinent to the subject matter of the paper. Sufficient was written, however, to show the pathway of duty in relation to the policy we cannot hesitate to condemn.

The importance of sketching details of machines, placing sizes and taking drawings from such, has been commented upon by several members, whose remarks give additional weight to what has been previously said on this. The encouragement of that *esprit de corps* by Mr. Lawrie and others should come home both to juniors and seniors. The conditions which militate against the apprentice while serving his time have been dealt with fully and need no further dwelling upon. The proposed alterations to the regulations for engineers before qualifying for the Board of Trade

certificates will no doubt greatly help to improve matters by insisting on a better workshop training, and prevent that rush for the engine-room of raw candidates who imagine their duties consist in watching the wheels go round, or whose ideas are founded on such fictional notions as those referred to by Mr. Lawrie in his quotation.

The use and abuse of perishable stores has been touched on, and the peculiar illustrations given by Mr. Kidd and Mr. Lawrie we can appreciate, and go to prove that the maintenance of trust and confidence between seniors and juniors is to be preferred to the continual aggravation caused by jealousy and ignorance, the one case resulting in a maximum of friction with a minimum of work, the other the reverse. It is conducive to the discipline and comfort of the ship to see the junior engineers keep themselves clean when off duty; there is no reason why an engineer should carry the grime of the stokehold and engine-room with him; at the same time let him take a pride in all his work, whether it be clean or otherwise—let there be as little hesitation in donning the boiler suit as the uniform coat, on the call of duty. Surely the day has gone by, and we may speak of it in the past tense, when the chief engineer jealously guarded his little bit of information from his juniors, and was ever unhappy when he saw them except coated with grime or bilge water and their intelligence being worried out of them by continual barking. Mr. Lawrie is hopeful, as I am, that the higher intelligence in the engine-room is prevailing to improve the conditions all round, tending to bring out the best points in both seniors and juniors, and creating that spirit of mutual confidence and respect which is necessary to harmonious working in the direction of economy both as regards upkeep and running expenses. The exhortation as to the manipulation of coal to get the best value out of it has been emphasised, and affords good food for study.

The proposal as to the granting of certificates by the Institute to young engineers would be somewhat difficult to carry out; still the lines suggested by Mr. McLaren and other speakers might be followed out and thought over, with a view to something being done to encourage the graduates and associates of the Institute to make themselves more efficient. Given a good mechanical training through the finger ends, and a thorough grasp of mechanics, the higher an engineer is educated in the direction of his business the more valuable he is to his employer and the more economical in his returns; he is better able to use his hands and his head, and to control and govern the hands of others by his head; the diagram given by Mr. Ruthven illustrates this. In closing I return thanks for the vote accorded and am pleased if my thoughts expressed in the paper have been of acceptable service to the Institute.

