

PAGES

MISSING



.. THE CENTRAL ..
Railway and
Engineering
Club ..
 OF CANADA

OFFICIAL PROCEEDINGS

Vol. I.
 No. 1.

TORONTO, CAN., January 19, 1907. \$1.00 per year.
 15c. per copy.

OFFICERS, 1906-7.

<i>President:</i>	J. J. FLETCHER, Supt. Boiler Dept. Canada Foundry Co.
W. KENNEDY, Master Mechanic, G.T.R.	J. CHRISTOPHER, Master Mechanic, T.H. & B.
<i>Vice-President:</i>	J. DODDS, Government Steamboat Inspector.
W. R. McRAE, Master Mechanic, T.R.Co.	J. C. GARDEN, General Foreman, G.T.R.
<i>Second Vice-President:</i>	<i>Auditors:</i>
R. PRESTON, Master Mechanic, C.P.R.	C. HUDSON, Car Distributor, C.P.R.
<i>Executive Committee:</i>	F. G. TUSHINGHAM, Chief Engineer, T.R.Co.
ACTON BARROWS, Managing Director, <i>Railway and Marine World.</i>	GEO. BALDWIN, Yardmaster, Canada Foundry Co.
C. J. JEFFERIS, Master Mechanic, Con. Gas Co.	<i>Secretary-Treasurer:</i>
H. H. BREWER, Terminal Supt. G.T.R.	C. L. WORTH, Chief Clerk, M.M. Office, G.T.R.

Published every month, except June, July and August by the
 Central Railway and Engineering Club of Canada.

C. L. WORTH, Sec.-Treas., Room 409 Union Station, Toronto.

CONSTITUTION AND BY-LAWS.

THE NAME SHALL BE

Section 1.—The Central Railway and Engineering Club
 of Canada.

OBJECTS.

Section 2.—The object of this Club shall be the advancement and dissemination by means of reports, papers, investigations and discussions of knowledge concerning the construction, operation and maintenance of railways and railway equipment and engineering subjects, and the cultivation of sociability among its members.

Section 3.—No patentees or their agents or agent for the sale of railway supplies shall occupy the attention of any Club meeting in the interest of the device in which they are personally or financially interested, unless they are especially invited to do so by a majority vote of the members present or by consent of a majority of the Executive Committee, and the article they represent forms a part of the subject for discussion.

MEMBERSHIP.

Section 4.—The membership of this Club shall consist of persons interested in any department of railway service, engineering or kindred interest, or persons recommended by the Executive Committee.

Section 5.—Persons elected by a majority vote of the Executive Committee shall become members on payment of the annual fees for the current year. Subscription of persons becoming members during the months of October, November and December will entitle them to membership for the ensuing year.

Section 6.—The membership shall continue until written resignation is received by the Secretary, unless forfeited by non-payments of fees.

Section 7.—Persons may be elected to honorary membership in this Club by the unanimous vote of the members present at any regular meeting, and shall be entitled to all privileges of membership, but shall be excluded from payment of the annual fees.

OFFICERS.

Section 8.—The officers of this Club shall consist of a President, Vice-President, a Second Vice-President and Executive Committee of seven members, one of whom shall be the immediate past President, and an Audit Committee of three members and the Secretary-Treasurer.

ELECTION OF OFFICERS.

Section 9.—The officers shall be elected by ballot at the Annual Meeting in December of each year or until their successors are chosen.

Section 10.—At the meeting preceeding the Annual Meeting a nominating committee of five shall be elected, who shall present at the Annual Meeting nominees for each office to be filled; it shall be the privilege of any member of the Club to nominate other candidates, the nominee receiving the highest number of votes for each office, to be declared elected.

Section 11.—A Secretary-Treasurer shall be appointed by a majority vote of the Executive Committee at its first meeting after the annual election, or as soon thereafter as the vote of the majority members of the Executive Committee can be procured for a candidate. The term of office of the Secretary-Treasurer thus appointed shall terminate with the appointment of his successor. The Executive Committee shall have power by a two-thirds vote of all its members to remove the Secretary-Treasurer and appoint his successor at any time. The rate of compensation of the Secretary-Treasurer shall be fixed for the time that he holds office by a majority vote of the Executive Committee.

Section 12.—Any other vacancy that occurs may be filled at any regular meeting by ballot, due notice of the election having been given in the regular call for the meeting.

DUTIES OF OFFICERS.

Section 13.—The President will preside at all regular or special meetings of the Club and perform all duties pertaining to a presiding officer; also serve as a member of the Executive Committee.

Section 14.—The Vice-President, in the absence of the President, will perform all the duties of that officer and will serve as a member of the Executive Committee.

Section 15.—The Second Vice-President, in the absence of the President, and the Vice-President, will perform all the duties of those officers and will serve as a member of the Executive Committee.

Section 16.—The Secretary-Treasurer will attend all meetings of the Club or Executive Committee, keep full minutes of their proceedings, preserve the records and documents of the Club and receive all monies and deposit the same in the name of the Club in a chartered bank approved by the Executive Committee, draw cheques for all bills presented when approved by a majority of the Executive Committee present at any meetings of the Club, or Executive Committee meeting. All disbursements of the funds of the Club shall be by cheque signed by the President and Secretary-Treasurer. He shall have charge of the publication of the Club proceedings and perform other routine work pertaining to the business affairs of the Club under the direction of the Executive Committee.

Section 17.—The Executive Committee shall exercise a general supervision over the interest and affairs of the Club; they shall arrange the programme for meetings and entertainments; authorize all expenditures of the Club, but shall

have no power to make the Club liable for any amount beyond that which at the time of contracting such expenditure shall be in the treasury, and not subject to prior liabilities.

Section 18.—The duties of the Audit Committee shall be to audit the books and accounts of the Secretary-Treasurer.

AMENDMENTS.

Section 19.—The Constitution may be amended at any regular meeting of the Club by a two-thirds vote of the members present, notice of the said amendment having been presented in writing at a previous meeting and a copy of proposed amendment having been mailed to each member.

BY-LAWS.

Section 1.—The regular meetings of the Club shall be held in Toronto, Canada, third Tuesday of each month at 8 p.m., excepting June, July and August, and a majority of the Executive Committee shall have authority to change the date and place of meeting if necessary for any special purpose.

Section 2.—The annual meeting shall be held on the third Tuesday of December of each year, at 8 p.m.

Section 3.—The President may call special meetings at such times as he may deem expedient, or on the written request of at least five members.

QUORUM.

Section 4.—At any meeting of the Club, fifteen members shall constitute a quorum for the transaction of business.

FEEs.

Section 5.—The annual fees shall be \$2.00 payable in advance on the third Tuesday of November of each year.

Section 6.—At the Annual Meeting of the Club the names of those members whose annual fees are still unpaid for the year then ending shall be dropped from the roll, previous notice of at least sixty days having been given such members by the Secretary-Treasurer. The proceedings of the Club shall not be mailed to persons whose names have been dropped from the membership roll, and such persons shall not be eligible for future membership until all back fees are paid.

ORDER OF BUSINESS.

Section 7.—

1. Reading minutes of previous meeting.
2. Remarks of President.
3. Announcement of new members.
4. Report of Standing Committee.
5. Unfinished business.
6. New business.
7. Reports of Special Committees.
8. Unfinished discussion of papers read at previous meeting.
9. Reading of papers or reports and discussion thereof.
10. Topical discussion of questions submitted by members.
11. Appointment of Committee.
12. Election.
13. Announcements
14. Adjournment.

PUBLICATIONS.

Section 8.—The proceedings of the Club or such portion thereof as the Executive Committee shall decide, at meetings, shall be published (standard size, 6x9 inches) and mailed to members of the Club, and to members of other similar Clubs with whom exchange is made.

Section 9.—The published proceedings of the Annual meeting of the Club, shall contain the Constitution and By-laws of the Club, with the names, titles and addresses of the officers and members.

AMENDMENTS.

Section 10.—Amendments to these By-laws may be made at any regular meeting of the Club by a two-thirds vote of the members present, notice of such amendment having been presented in writing at a previous meeting and a copy of proposed amendment mailed to each member.

LIST OF MEMBERS.

- | | | |
|------------------|-----------------|----------------------|
| Acton Burrows. | J. Markey. | A. E. Juhler. |
| R. Ivers. | J. Christopher. | C. M. Murray. |
| J. C. Garden. | R. L. Nelles. | R. Preston. |
| J. H. Stortz. | J. J. Beck. | W. J. Jones. |
| C. A. Jefferis. | W. H. Moore. | C. M. Wilson. |
| Geo. Renton. | W. Evans. | R. M. Card. |
| W. R. McRae. | G. S. Thomson. | H. J. McAddie. |
| A. S. Wright. | E. V. Burwell. | G. A. Wilkie. |
| J. V. Jackson. | I. W. Evans. | R. Pearson. |
| H. H. Brewer. | R. Treleaven. | H. Ellis. |
| J. Irwin. | J. L. Hodgson. | J. McWater. |
| J. Mooney. | A. Maynes. | G. Shand. |
| W. H. Smart. | F. Clement. | J. Bannon. |
| W. J. McKee. | N. MacNicol. | A. M. Grantham. |
| W. T. Walker. | W. H. Alderson. | W. R. Tiffin. |
| E. Logan. | W. Hall. | A. J. Stanford. |
| J. J. Fletcher. | W. Alderson. | H. G. Fletcher. |
| F. G. Tushingam. | W. E. Saylor. | G. A. Mitchell. |
| W. A. Nixon. | W. Loveridge. | A. W. Durnan. |
| J. Dodds. | R. M. Hunter. | J. T. Carlind. |
| W. M. Borthwick. | J. Weir. | W. H. Smith. |
| T. G. Lewis. | S. L. Tusler. | E. D. Bly. |
| W. Gell. | R. Patterson. | R. G. Gilbride. |
| H. Cowan. | J. W. Harkom. | A. R. Thompson. |
| G. Baldwin. | D. Richardson. | E. T. Piper. |
| C. L. Webster. | F. Brodie. | J. B. Wilson. |
| J. M. Clements. | C. F. Barnes. | F. W. Burrows. |
| W. R. Blowers. | J. H. Wallace. | R. Ashton. |
| G. Black. | E. C. Adams. | C. A. Andrews. |
| R. O. McKay. | W. S. Pardoe. | A. J. H. Eckardt. |
| A. G. McLellan. | J. Long. | H. Winnett. |
| W. Kennedy. | F. Sanderson. | W. T. Giles. |
| C. L. Worth. | P. J. Lynch. | B. M. Armstrong, jr. |
| W. Loach. | H. B. Ayers. | J. R. Dickson. |
| I. Jefferis. | E. W. P. Jones. | P. J. Myler. |
| J. E. Houghton. | G. McIntosh. | J. A. Kilpatrick. |
| J. F. Campbell. | A. B. Brown. | A. Dixon. |
| | | J. A. Mitchell. |

SYNOPSIS OF MEETINGS HELD NOVEMBER 9TH,
AND DECEMBER 18TH, 1906.

At meeting held November 9th, the Club started out with a membership of thirty-four. At this meeting a vote of thanks was tendered to Mr. Acton Burrows for the assistance he had rendered in the formation of the Club, he acting as Chairman at meetings. A vote of thanks was also tendered Master Mechanic, Grand Trunk Railway, Mr. T. McHattie, past President of the Canadian Railway Club of Montreal, and Mr. J. Powell, Chief Draughtsman, Grand Trunk Railway, Secretary of the Canadian Railway Club of Montreal, for their attendance at the meeting and assistance given in the formation of this Club.

At meeting held December 18th in Room 315 Union Station, Mr. Acton Burrows in the chair, the membership was reported as having increased to sixty-six, which was considered very gratifying and spoke well for the success of the Club.

Mr. W. Kennedy,—

I appreciate very much the honor you have done me in electing me to the position of President. While you may have chosen a better one I assure you that I shall do everything in my power to further the interests of the Club. It is a duty that I feel called upon to perform as President of your Club, to ask some member to move a vote of thanks to Mr. Acton Burrows for the interest he has taken in the Club.

Mr. W. R. McRae,—

As a late member of the Executive I have much pleasure in moving a vote of thanks to Mr. Burrows for the able manner he has filled the office of Chairman. Seconded by Mr. Garden.

Mr. A. Burrows,—

I am exceedingly obliged. It has been a great pleasure to me and as a member of the Executive Committee I shall always try to attend the meetings of this Club, and trust that at our next meeting this room will not be large enough.

Mr. W. Kennedy,—

We are starting off with a membership of sixty-six which is very encouraging and goes to show the interest that is being taken in this Club, and I trust that each and every one of you will endeavor to help the Club along by endeavoring to induce others to become members. With the very able Executive Committee we have and the support we trust we will get from

the members, the Club will undoubtedly be successful, and it behooves every member, not only to put in his membership fee, but also his appearance at each meeting. We have not as large an attendance as we had the previous meeting, but in all probability the Christmas holiday had something to do with this, and I know there are a great many present who are deeply interested in this Club, and I request that all those present to-night will not only be present at the next meeting, but bring as many as possible with them.

I had the pleasure of attending a meeting of the Canadian Railway Club at Montreal. They had a very large attendance, to listen to a paper given by Mr. Bell, General Passenger and Ticket Agent of the Grand Trunk Railway. No doubt a number of you who are members of the Club have received a copy of the paper. It was a very interesting one and one that brought forth discussion that was also very interesting. At the meeting I chanced to be the only member of the Central Railway and Engineering Club present and they called upon me for a few remarks. I explained to them the progress we had made in organizing this Club and everyone seemed pleased to hear that such a Club was organized, and the President expressed himself pleased to help us in any way with our Club, and by an unanimous vote of the members present an invitation was extended to all members of the Central Railway and Engineering Club of Canada to attend their meetings at any time when in Montreal. I may say for those present who have not attended any meetings in Montreal that their Club is flourishing. A great number of the prominent Railway officials and others of Mercantile lines were present, and it was a pleasure to see the number that were present that were not connected with Railways. We want outside membership and from time to time we will appreciate it very much if the other lines of business outside of Railway affairs will give papers that will be of interest to us. I have been connected with Railway work since boyhood, and one thing that struck me very forcibly, when listening to Mr. Bell, was how little we knew of other work. I realize that we, as Railway men, will have the advantage of learning a great deal of what the other fellow is doing and be able to teach him a little about what we are doing, and this being the object of the Club I hope each and every one will take an interest, as I said before in enlarging the membership and the attendance.

Mr. W. R. McRae,—

I do not know that there is anything very much I have to say, but tender my sincere thanks for placing me in the position of First Vice-President, and I want to say that I am very pleased to be able to serve under such an efficient chief

as we have elected this evening. I cannot say that I am a stranger in a strange land seeing that I am connected with the Electric Railway interests. The situation of Electrical Engineering is advancing with rapid strides and it seems there is nowhere where Electric Railway people are out of place and competing with Steam Railway men in their work.

I beg to thank you again for electing me to this position and I am sure I will do my utmost to fill it thoroughly.

Mr. H. H. Brewer,—

I do not know that I can say very much to-night. However I am satisfied that the organizing of this Club will be a great benefit to each and every one of us. We become absorbed in our own line of business and know very little about the other fellow and when brought in contact we will certainly benefit by it, and I am very glad to be a member and take part in the same.

Mr. J. C. Garden,—

I do not feel that I have anything to say to-night, yet I am very glad that this Club has been organized. Mr. Kennedy has given me a great deal of credit for organizing this Club. We had in connection with our Works, a Club which we organized to which each Foreman in our shop was a member; we held meetings once a month for about two years. Mr. Baldwin was Secretary, and from these meetings we found from our small circle we had not enough members to carry the meetings any further and the idea of organizing a Club was introduced. Most of us could not get away to Montreal as we did not feel we could absent ourselves for two or three days.

I am very pleased with the Officers and Executive and I am quite willing to do anything in my power to further the interests of this Club.

Mr. Geo. Baldwin,—

I think myself that we have made a step in the right direction, as has been remarked by Mr. Kennedy and Mr. Garden. We had a little of this business once before and we found it a great success with the exception that we were not strong enough to carry this to a successful issue. There were some splendid papers and I think each Foreman undertook to write a paper on some subject in connection with our work, but we did not branch out into any other lines of business other than Grand Trunk Railway business, along mechanical lines. I think the same as our President, that the Club should endeavor to bring in members of outside industries as well as railway men and that we will hear something to the advantage of the railway men.

Mr. Acton Burrows,—

I would recommend that any person desiring a discussion on any subject the same be forwarded to the Secretary, he to advise members when sending out notices of meetings.

Mr. R. Patterson,—

I am a member of the Canadian Railway Club at Montreal and have always found the papers read by members and the discussion thereon interesting and instructive but as the distance to Montreal is so far, it is impossible to attend the regular meetings and in consequence, the most important part of the proceedings, that is the discussion on papers and questions asked, were lost to the members who were unable to attend, and while I still intend to remain a member of the Canadian Railway Club at Montreal, it affords me a great deal of satisfaction to know that we will have a Club in Toronto and I anticipate being able to attend regularly.

It is gratifying to find that the Club is starting out at its formation with such an excellent staff of officers representing different industries. While a great measure of responsibility rests with them at the commencement of the Club for its future success, the same responsibility applies to each individual member. It augurs well for the Club's future success, that we are starting with so many members that are identified with such varied classes of work. As we are all liable to get into a rut following our own particular lines of business, by getting papers from the gentlemen on different subjects who are thoroughly conversant with them, we will by that means get a good deal of valuable information which otherwise we would not be able to obtain. In these strenuous times it is nearly all we can do to get posted and read up along our own line of work and by getting together, we are going to get the experience of various members on a diversity of subjects and acquire easily information which we could not obtain in any other way. I am pleased to see so many present to-night and as I understand the Executive will have some representative gentleman prepare a paper for our next meeting. I hope that even a larger number will be on hand and during the interval each one will endeavor to obtain as many new members as possible.

MEETING HELD JANUARY 15TH, 1907.

Mr. W. Kennedy, (Chairman),—

The first part of business according to our By-laws is the reading of the minutes of the last meeting, copy of which I understand the Secretary has forwarded to each member. It will, therefore, not be necessary to have the minutes read.

We regret that we have not got better accommodation in

the way of a meeting place. A committee, however, was appointed to look for better quarters at the last meeting and we will likely hear from them later on.

Since the last meeting we have added to the membership considerably, nearly all the members of the Club having brought in new members, and the Secretary informs me that a member of our Executive has brought in eighteen new members since the last meeting. This is Mr. Jefferis to whom I know a great deal of credit is due, and they are members that we are proud to have with us.

Mr. C. A. Jefferis,—

Mr. Brewer, the Secretary and myself on the 7th inst., were around looking for a place of meeting. We visited the King Edward, the Queen's, the St. Charles and the Temple Building, but at none of these places were we able to procure a suitable room. In fact the only place where we were offered a room was at the Queen's, and I am sorry to report that it was altogether too small.

Chairman,—

I might add to the remarks of Mr. Jefferis that in addition to them looking for a place I made some inquiries myself and think we will meet with some success in securing the Theatre in the Normal School.

Chairman,—

"New Business." I might say for your information that owing to the election of Mr. W. R. McRae and Mr. R. Preston to the positions of Vice-President and Second Vice-President has left two vacancies on the Executive Committee, and it being the custom for the Executive Committee to propose members for the vacancies, at the last meeting of the Executive Committee it was decided that we propose Messrs. J. C. Garden, General Foreman Grand Trunk Railway, and Jno. Dodds, Government Steamboat Inspector.

Any other member wishing to nominate anyone else for these vacancies is of course at liberty to do so.

Mr. Spadile, Superintendent Canadian Northern Railway, being the only other candidate nominated, Messrs. Dodds and Garden were elected.

Chairman,—

The next line of business is the reading of papers and discussions thereof. I am sure you will all be pleased to learn that we have with us to-night Dr. Galbraith, Principal of the School of Science, who has kindly consented to give us a paper

on Iron and Steel, which I am sure will be to our benefit. We know from all we have heard of the Doctor that everything he has for us in this line will be very much appreciated.

I have now much pleasure in introducing to you Dr. Galbraith, the Doctor being an authority on the subject of metals.

LECTURE ON IRON AND STEEL.

BY DR. J. GALBRAITH, PRINCIPAL OF SCHOOL OF PRACTICAL SCIENCE, TORONTO UNIVERSITY.

After expressing his pleasure at being invited to address the Club on the occasion of their first public meeting, the lecturer proceeded to explain in a general manner, the point of view from which he intended to treat the subject, a point of view which he had no doubt would be novel to many of his audience.

He then referred to the customary methods of examining and testing irons and steels, viz.: by chemical analysis, by the use of testing machines, for pulling, bending, drop testing, etc., and also by shop methods, in observing the behavior of the metal under the file, lathe tool, or the appearance of the sparks given off at the emery wheel, etc.

He stated that the microscope is now coming into use as an additional aid, and he proposed to give them some of the principal results of microscopic work. The slides used to illustrate the lecture were made at the School of Practical Science, from various specimens in use in the Mechanical Laboratories.

The first slide exhibited, showed a set of parallel lines 1-100 millimetre, or 1-2500 of an inch apart. This was under the same conditions of magnification as the iron and steel slides. By rough measurement with a foot rule, the screen magnification was found to be about 6000.1 lineal measurement. It thus became easy to determine from the screen, the actual diameters of iron grains, the thickness of graphite plates, etc.

WROUGHT IRON.

Slides showing the cross-section and longitudinal section of three varieties of wrought iron, viz.: Common, Lowmoor, and Swedish, were then thrown on the screen. The slag fibres and the iron fibres were distinctly shown; the latter being built up of irregular grains, and exhibiting the appearance of uncoursed, rubble masonry. Measurements made on the screen showed the diameter of the grains to be in the neighborhood of 1-500 of an inch, and the iron fibre to have a thickness of about 1-100 of an inch.

STEEL.

The next slides showed steels made by the Bessemer, Open Hearth, and Crucible processes. These were arranged roughly in the order of the carbon percentages. They comprised longitudinal and cross-sections of rivet steel, boiler plate, structural steel, machinery steel, and tool steel.

MICRO-STRUCTURE OF UNTREATED IRONS AND STEELS.

The common characteristic of these views was the appearance of dark, well defined patches on a light background. The background showed the same grained structure as the iron fibres in puddled iron, while the dark patches were distinctly different from the slag shown in the views of wrought iron. Little or no slag appeared in the steels. The dark areas represented *pearlite*—an iron carbon alloy containing somewhat less than one per cent. of carbon. As the carbon content increased, the dark areas increased also, while the white areas diminished. It is convenient to term the carbonless iron, which is indicated by the white areas, *ferrite*.

Thus the wrought irons are made up of ferrite and slag fibres; the steels, of pearlite masses embedded in ferrite masses. The last slide of this series showed pearlite only, indicating that the steel (a tool steel) contained about one per cent. carbon.

The steels and irons shown up to this point were in the condition in which they had left the manufacturers' hands, and as they had been received from the dealers.

APPEARANCE OF TREATED IRON AND STEEL.

The next slide showed the same tool steel as in the previous slide, after it had been heated to a cherry red and suddenly quenched in water; that is, had been hardened preliminary to tempering. The structure was distinctly different from that of the pearlite shown in the previous slide. The material thus treated is termed *martensite*, and if martensite is gently heated, it is partially transformed into pearlite, thus becoming softer. By heating to a red heat, and cooling slowly, it becomes completely changed into pearlite. The martensite being very hard, the pearlite comparatively soft; any intermediate degree of hardness is thus attainable.

The next slide indicated a tool steel containing about 1.25 per cent. carbon. It showed pearlite areas surrounded by narrow, white boundaries. On account of the carbon composition, this steel could not consist of pearlite and ferrite, therefore, the white boundaries did not represent ferrite, *i.e.*,

carbonless iron. They represented a chemical compound of carbon and iron, termed *Cementite*, containing about seven per cent. carbon.

THEORETICAL STEEL.

Thus theoretically, all the steels containing from about one to seven per cent. of carbon, might be composed of only pearlite and cementite, if the proper conditions obtained in the manufacture. As a matter of fact, the iron-carbon alloys containing from 1.5 to 2.5 per cent. carbon, are not common in the arts.

CAST IRON.

Above 2.5 per cent. the alloy is usually termed cast iron. If it consists of pearlite and cementite, it is known as white cast iron. The irons of commerce do not, as a rule, contain more than, say, 4.5 per cent. carbon.

Owing to the manufacturing processes not being always favorable to the production of white cast iron, what is called grey cast iron is produced instead; without necessarily any alteration of the carbon content.

In grey cast iron, the carbon, instead of being wholly in the pearlite and cementite condition, as is the case when the iron is white, is partially in the form of graphite; thus grey cast irons may contain pearlite, cementite and graphite; pearlite and graphite; pearlite, ferrite and graphite; or finally ferrite and graphite.

Several slides were exhibited showing some of these varieties of grey cast iron.

The graphite in these cases forms into layers more or less curved. The metal is so cut up by these graphite layers that it is rendered comparatively brittle, soft, and weak. The white cast iron, while brittle, is hard and strong.

A slide was thrown on the screen showing the pearlite-cementite composition of white cast iron.

MALLEABLE CAST IRON.

An interesting slide representing the micro-structure of malleable casting was shown. The structure consisted of ferrite and graphite. The graphite, instead of being in the form of layers, as in grey cast iron, takes the form of minute lumps, showing on the screen as roundish spots. In this iron the graphite consists of minute lumps surrounded by ferrite; while in the ordinary grey casting of similar composition, the metal is more or less surrounded by layers of graphite, rendering the grey casting brittle, and the other malleable.

Malleable cast iron is made by annealing at a red heat, a casting of white iron containing little or no graphite. Owing to the effect of the anneal, the carbon separates out in the form distinctive of malleable castings.

MICRO-STRUCTURE OF A STEEL RAIL.

The lecturer then showed the structures at various points in the cross-section of a steel rail. The grain structure (pearlite and ferrite) was small near the skin, but increased in size as the interior was approached. The interior metal of a worn rail is less durable than that at the original surface.

CHARACTERISTICS OF SPECIAL STEELS.

Finally, some specimens of almost pure iron and high carbon steels made in the electric furnace were shown on the screen. Also cross-sections of Novo Steel (high speed tool steel) before and after hardening.

Chairman,—

I am sure all those present have listened with a great deal of interest to the lecture given by Dr. Galbraith, and I am satisfied that if your Executive are as fortunate in procuring a gentleman of this caliber to give us lectures on papers at our future meetings there will be no doubt whatever as to the success of the Club. I am sure we are all greatly indebted to Dr. Galbraith for his courtesy and taking up so much of his valuable time in coming here this evening to deliver us this lecture and we trust that in the near future we will again have the pleasure of hearing from him.

The Executive I understand have arranged for a suitable paper for our next meeting, of which you will receive due notice from the Secretary, and I feel quite satisfied from the interest displayed this evening that we will not only have those present again with us at our next meeting, but we trust that you will bring all your friends and members of the Club with you.

As the hour is growing late I do not feel that we would be justified in opening a discussion as to the lecture given us by Dr. Galbraith. However, he has already devoted so much of his valuable time to his paper that we feel this would be an imposition.

Dr. Galbraith,—

I am sure it has been much pleasure to me to be with you to-night and give you this paper; part of my time at one time being spent in connection with railway work, and if at any time in the future I can be of any assistance to the Club I shall only be too glad to do so and the Club has my best wishes for its future success.