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Railway and Engineering Club

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OF CANADA

OFFICIAL PROCEEDINGS

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

Phones: Day, Main 4860
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PROCEEDINGS OF THE CENTRAL RAILWAY AND ENGINEERING CLUB OF CANADA MEETING.

PRINCE GEORGE HOTEL, TORONTO, *December 19th*, 1911.

The President, Mr. Baldwin, occupied the chair.

Chairman,—

The meeting will now come to order.

The first order of business is the reading of minutes of the previous meeting.

Mr. Herriot,—

As we have all been supplied with a copy of the minutes of the previous meeting, I move, Mr. Chairman, that the minutes of the previous meeting be adopted as read.

Mr. Lewkowicz,—

I second that.

Chairman,—

It has been regularly moved and seconded that the minutes of the previous meeting be adopted as read. What is your pleasure, gentlemen? Carried.

Chairman,—

The next order of business is the remarks of the President. As you are all aware, this is my last night in office, and, as the Irishman would say, "If there is anything I am sorry for I am glad of it." I am sorry in one sense that I am leaving this chair for the simple reason that you have treated me so well that I feel I could sit here for ever, but again life is too short for one man to hold this office more than one year, especially when he knows that there are better men than himself to follow him. I feel that we have very good men in our Club who are quite able to uphold the reputation of the office of President equally as well as I have done, and I am sure that when you hear the names of those who have been picked out by the Nominating Committee that you will concur in what I have said.

I am a member of various organizations and societies, and I may say that I have been honored with the same position I hold here in several of them, but I can safely say that there is no presiding officer's chair I have held that has given me greater pleasure or that I have felt more proud of than in this position, and I want to thank you one and all for the hearty support you have given me during my year.

Owing to the "Smoker," I presume, as much as anything we have got to-night, what I have been looking for for a whole year, a good list of new members. I am very glad to see that quite a number of members have, as our Secretary would say, got busy and brought in some new members.

The next order of business is the announcement of new members.

NEW MEMBERS.

C. Laeon, Shipper, Canada Foundry Co., Toronto.

J. E. Rawstron, Storekeeper, Canada Foundry Co., Toronto.

H. V. Sprecken, Assistant Foreman, Molding Department, Canada Foundry Co., Toronto.

A. W. Ritchie, Boilermaker, Canada Foundry Co., Toronto.

W. Harvey, Machinist, G.T.R., Toronto.

A. E. Terry, Machinist, G.T.R. Toronto.

J. Scanlon, Travelling Engineer, G.T.R., London, Ont.

H. Spratt, Travelling Engineer, G.T.R., Hamilton, Ont.

P. Smith, Boilermaker's Assistant, G.T.R. Roundhouse, Stratford, Ont.

J. M. Beswick, Bookkeeper, Standard Foundry, Toronto.

A. Woodley, Molder, Standard Foundry, Toronto.

H. G. Woodley, Assistant Foreman, Standard Foundry Co., Toronto.

H. Hughes, Machinist, Polson Iron Works Limited, Toronto.

F. A. Harrison, Boilermaker, Polson Iron Works Limited, Toronto.

J. H. Marshall, Boilermaker, Polson Iron Works Limited, Toronto.

J. A. Dickinson, Clerk, Polson Iron Works Limited, Toronto.

H. H. Cheesman, Ship Draftsman, Polson Iron Works Limited, Toronto.

J. H. Williams, Associate Editor, *Canadian Machinery*, Toronto.

P. H. Fox, Chief Despatcher, Canadian Northern Ontario Ry., Toronto.

P. Bain, Editor, *Marine Engineering of Canada*, Toronto.

R. B. Shepherd, Engineer, City Hall, Toronto.

R. Mullen, Steamfitter, Evans Almirall Co., Toronto.

J. Anderson, Marine Engineer, Toronto.

J. W. Madigan, Electro Chemical Engineer, Toronto.

A. E. Quinn, Commercial Traveller, Toronto.

J. A. Findlay, Marine Engineer, Niagara Navigation Co., Toronto.

H. O. Phillips, Salesman, Canadian Steel Foundry Limited, Toronto.

F. C. Harding, Manager, Harding Motor Car Co., London.

R. M. Jaffray, Manager, *Motor Times*, Windsor.

W. L. Jannet, Electrician, Toronto.

J. McGill, Electrician, Massey-Harris Co., Limited, Toronto.

J. N. Gregory, Manager, Dearborn Drug & Chemical Works, Toronto.

J. W. Aston, Chief Engineer, Toronto Ferry Co., Toronto.

W. McDonald, Manufacturers' Agent, Toronto.

H. Goods, Foreman, John Inglis Co., Toronto.

D. Russell, City Representative, Canadian Fairbanks Co., Toronto.

F. Harding, Financial Manager, Harding Motor Car Co., Newmarket, Ont.

W. Fish, Machinist, Gurney Foundry Co., Toronto.

G. Beck, Machinist, Gurney Foundry Co., Toronto.

Chairman,—

I think that is a very creditable list. These gentlemen have been passed on by the Executive, and consequently have been elected as members of the Club.

MEMBERS PRESENT.

A. J. Lewkowicz	A. M. Wickens	J. Reid
L. M. Watts	C. Thurston	J. M. Beswick
W. A. Grocock	W. H. N. Davis	A. W. Ritchie
F. Harrison	J. Bannon	J. A. Dickinson
H. Cheesman	J. H. Marshall	G. P. Beswick
F. Moody	H. G. Fletcher	C. A. Jefferis
J. P. Law	H. V. Armitage	F. Slade
C. F. Neild	G. D. Bly	A. Woodly
F. J. Ross	A. E. Quinn	R. Coxon
J. Wright	J. Branston	B. Dillon
H. Vivian	J. H. Morrison	G. C. Keith
G. F. Milne	J. A. Findlay	F. D. Dewar
R. M. Carmichael	W. Large	J. Herriot
C. Meldrum	D. Davidson	J. A. Disney
H. Goodes	E. Morrison	J. Adam
T. McKenzie	F. Hardisty	J. Barker
C. DeGruchy	W. Evans	G. Black
G. Cooper	F. R. Wickson	W. C. Sealey
E. Logan	J. Dodds	W. J. Jones
S. Best	L. S. Hyde	C. L. Worth
G. Baldwin		

The next order of business we will deal with, is the reading of papers or reports and discussion thereof.

We have with us to-night Mr. G. C. Keith, who is no stranger to us. He gave us a paper a year ago at this time.

Mr. Armer was to have given us a paper to-night, but unfortunately he cannot be here, consequently Mr. Keith has kindly consented to fill the gap. I will therefore call upon Mr. Keith to read us the paper.

CUTTING OUT THE LEAKS IN RAILWAY WORK.

BY J. C. ARMER, B.A.SC., MANAGER OF "THE RAILWAY JOURNAL," TORONTO.

INTRODUCTION.

Efficiency has always been a hobby of mine—that is to the extent that a man in my position can have a hobby. When your secretary asked me to give a paper before your Club, I told him that there was no subject I could choose that could not be dealt with to much better advantage by some other member. Someone suggested Efficiency and Economy in Railway Work, and I succumbed for the hobby's sake.

For some years I have devoted a good deal of time to the study of, and to placing before others, efficient and economical methods of manufacturing; and I might refer first hand to many cases in Canadian factories where a little study, a little co-operation, and a little application of efficient methods have been the means of saving large sums of money annually. In railway work I have not had as much personal experience, and therefore the cases referred to here are not from personal observation, but have been gathered from many reliable sources, and no doubt are better because of that.

EFFICIENCY AND ECONOMY IN BUYING.

In the final analyses efficiency and economy are inseparable. One cannot have economy without efficiency; nor can one have efficiency without real economy. Unfortunately so-called economy is too often a stumbling block in the way of efficiency. In buying, many of the electric railways in Canada and some of the steam railways interpret "economy in buying" to mean "cheapness in buying." The efficiency and durability of a product in relation to its price is not given proper consideration.

A purchasing agent to really purchase economically, should, if he is not merely purchasing to detail specification, follow the life of the product he purchases from the time it is new until it is scrapped; he should consult everyone who has anything to do with the direct use of it; he will thus learn its good points, its bad points, its durability and its efficiency compared with other products of a similar nature. If the buyer does this he can compare value in relation to price; and then the railway, instead of having a one-man buyer, will have the entire organization as a buyer, since the knowledge and experience of the entire organization will enter into each purchase.

The first place to look for leaks in railway work and to cut them out is in the purchasing department. The only excuse for purchasing cheap and inefficient equipment and supplies is a very stringent capital account. If an organization is suffering from lack of capital one cannot hope to obtain the greatest efficiency. Private corporations are often handicapped in this way, but the average railway corporation is not.

POSSIBILITIES OF SAVING IN RAILWAY OPERATION AND MAINTENANCE.

The heart of this subject is reached when we discuss efficiency in the operation, maintenance, and repair of railways. This is such a big subject, that I cannot hope to more than touch it here and there. The object is to get the members interested in this subject of efficiency, because co-operation, I believe, is the backbone of efficiency, and the more railway men there are looking for ways and means of cutting out leaks, the more efficiently will railways be operated, and the more valuable to himself and to the railway will each railway man be.

A factory superintendent—an acquaintance of mine—by co-operation—that is, by getting all his foremen and even the men imbued with the idea of cutting out leaks—saved over $12,000 a year by eliminating wastes—and that in a factory which previous to this was better organized than 95 per cent. of the factories in Canada.

CO-OPERATION AND SCIENTIFIC MANAGEMENT IN OBTAINING EFFICIENCY.

There is the waste of time and the waste of materials. These are separate yet closely related. "Scientific Management," or "Efficient Management," as it might well be called, will be the means of eliminating a lot of waste in railway work. In fact it is only by the adoption of the principles of scientific management in some form or other that many of the wastes so prevalent can be eliminated. On the other hand by means of a little co-operation and by the exercise of ordinary good sense on the part of railway men immense savings could be brought about without anyone concerned even thinking of scientific management.

So many statements have been made to the effect that Taylor's system of scientific management is a "sweat-shop system," garbled accounts of the system being given to prove the point, that I am led to make this statement. The making of scientific studies of operations as they are performed, and the devising of methods and means of performing these operations so that the workman may produce more in a given time with the same expenditure of physical and mental effort: that is scientific management. This means a cutting out of wasted time and often of wasted materials, and also in the majority of cases a larger wage for the workman.

When a foreman in a shop instructs a mechanic, from previous experience, how best to set up a certain piece of work on his machine, so that the mechanic goes about the task in a way that has been proven to be most efficient, instead of having to try a dozen methods before he finds the best one: that is an example of scientific management. This very thing done thoroughly and systematically is real scientific management, or efficient management if you like that word better.

HOW SAVINGS MAY BE EFFECTED.

But this is not a paper on scientific management, but on methods of cutting out leaks in railway work.

L. C. Fritch, chief engineer of the Chicago Great Western Railway, has said:

"There is opportunity for waste, and great waste, in the railway business, in almost all of its various departments, and in a greater or less degree on all roads. Much of this waste is unavoidable by virtue of the peculiar nature of the business. But, on the other hand, much of it is unnecessary waste, and a large part of the unnecessary waste is ruthless and inexcusable waste. 'Ruthless waste makes woeful want,' is as true when applied to the railway business as to our private affairs. No employee would tolerate in his own private affairs the extravagance and waste often witnessed and sometimes practiced in his own employment for the railway company.

"It lies within the power of every employee of a railway corporation to practice prudent economy, no matter what his position, or how humble his sphere may be. This may take the form of economy in time, in the use of material, in avoiding possible loss or damage to property and in countless other ways that come to the attention of almost every employee in his daily experience."

Following are actual instances, picked up here and there, which will give one an idea of how money may be saved; and it is hoped that these will enthuse the members of this club with the spirit of cutting out the leaks; or be an added incentive to the many who, no doubt, have already given this a great deal of consideration.

CUTTING OUT LEAKS IN THE POWER PLANT.

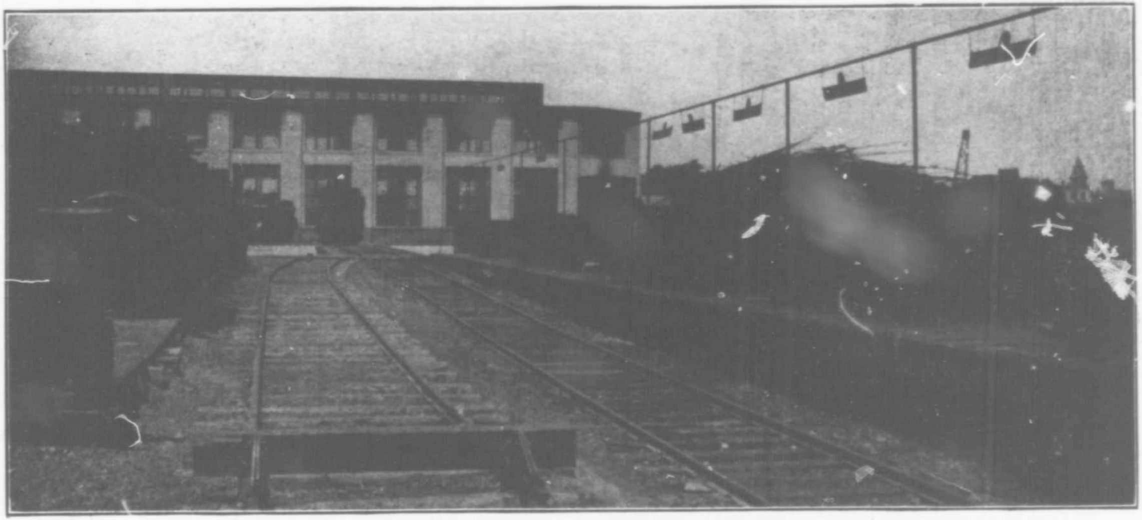
There's no better place to start to find leaks than in the power plant. My friend, Mr. J. J. Martindale, showed me a report which he had made for The Philadelphia Rapid Transit Company on the economies it was possible to bring about in the different power plants of their system, and their approximate cost. In four plants by more efficient methods of coal handling alone he found it possible to save $3,900 annually with a capital outlay of only $5,000. The saving would more than pay for the capital cost in eighteen months. Mr. Martindale showed that it was possible for this company to save more than $29,000 annually in the different boiler rooms alone, and this entirely exclusive of the saving which might be realized by better discipline and methods in the boiler room. I might go further into the various ways in which leaks may be cut out in the power plant, but this is enough for a suggestion.

OPPORTUNITY FOR SAVING LOCOMOTIVE FUEL.

Fuel for locomotives is one of the largest single items of operating expenses. It is impossible to attain the degree of efficiency with locomotive boilers that is possible with stationary boilers; but there is a large unnecessary waste in fuel for locomotive boilers, which if gone at in the proper way can be eliminated.

The use of mechanical stokers promises to result in a great saving of fuel. The advantages of mechanical stokers are: greater uniformity in distribution of fuel and the admission of proper quantities of air, resulting in more complete combustion of fuel. More experimental work is needed, however, before a perfectly satisfactory stoker is attained.

V. C. Randolph, supervisor of locomotive operation, Erie Railway, saved $28,605 worth of coal in three months' time on the Allegheny division, the cost of doing it amounting to little more than his own salary for that time. This result was attained by holding instruction classes in fuel economy, which were attended by engineers, firemen, engine preparers and fire cleaners, subjects discussed being shovelling of coal, loss of steam through pops, waste through the overloading of tenders, shaking good fire into the ash-pan, firing too heavily, bringing locomotives into terminals with heavy and dirty fires, waste of steam by engineers leaving reverse lever in corner too long in starting, not working steam as expansively as possible when running, by not supplying water to boiler at proper time, by



TAKING CARE OF SCRAP MATERIAL AT THE G.T.R. SHOPS, STRATFORD.

engineer running local trains too fast between stations, and then waiting for time, and working steam longer than necessary and then checking speed with brakes.

These meetings were held weekly for several months, and as a drawing card other subjects of direct interest to the engineers and firemen were taken up.

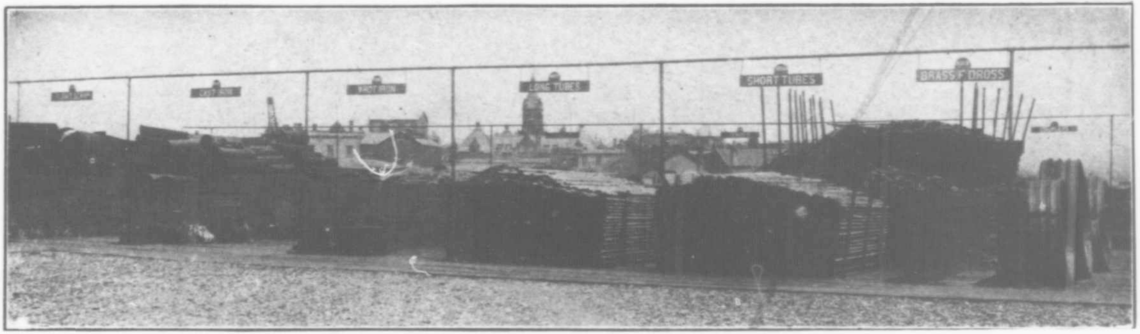
Reclaiming Scrap Materials.

A. A. Burkhard, Assistant General Foreman, Car Department, New York Central & Hudson River Ry., West Albany, says: "There is a wide difference of opinion as to the economy in working up and using scrap and second-hand iron. To the writer there does not appear to be any question from a saving standpoint or from the standpoint of safety when stock is used for certain classes of work."

In this car department they have a scrap platform with suitable buildings in connection, where the reclaiming of materials for freight car repair work is handled by a man thoroughly familiar with all requirements. In these buildings are installed the necessary machines for reclaiming the scrap, such as hammers, riveters, shearing machines, forges, etc. It is remarkable how many freight car parts can be made from second-hand materials. Some of the scrap materials that can be economically reclaimed are: scrap bolts, which can be reclaimed at an average cost of 1.3 cents per pound; truss rods, which can be straightened and used over again, or cut up and made into standard bolts; brake levers, which, if the holes are worn large, can have the holes plugged and new ones drilled; axles, which can be forged into parts such as follower plates; arch bars, which can be forged into coupler carry irons and draft timber ties; cross tie rods, which can be forged into bolts, brake hangers and grab irons; old jacket iron, which can be cut to proper shape and used for tacking on pilots to prevent snow going through the pilot; scrap lagging can be ground up and used again, the cost of grinding sufficient old lagging to cover one boiler being about $1.25. Many more cases might be enumerated.

Canadian railways are doing this class of work to some extent. Illustrations are here shown of the method adopted by the G.T.R. of preventing any spoilt materials being wasted. Twenty bins are arranged and above each in large easily read type is printed the name of the material to be piled in the particular bin. These are:

1. Cast Iron Borings.
2. Mixed Turnings.
3. Steel Turnings.
4. Tank Plate.
5. Iron Pipe.



TAKING CARE OF SCRAP MATERIAL AT THE G.T.R. SHOPS, STRATFORD.

6. Spring Steel.
7. Netting.
8. Couplers.
9. Mild Steel.
10. Steel Clippings.
11. Fire Box Steel.
12. Boiler Plate.
13. Burnt Scrap.
14. Cast Iron.
16. Wrought Iron.
17. Long Tubes.
18. Short Tubes.
19. Brass F. Dross.
20. Tires.

Another example of reclaiming waste is that adopted by the Toronto Street Railway for recovering babbit metal. A furnace has been devised with five burners, four playing on the bearing from which the metal is to be removed and one above. The babbit melted from armature bearings is run into ingot molds and used for axle bearings. When babbit is melted from axle bearings it is saved and analyzed, the proper ingredients being added to bring it up to its original composition. This procedure has resulted in appreciable savings.

Motor Cars Increase Efficiency in Section Work.

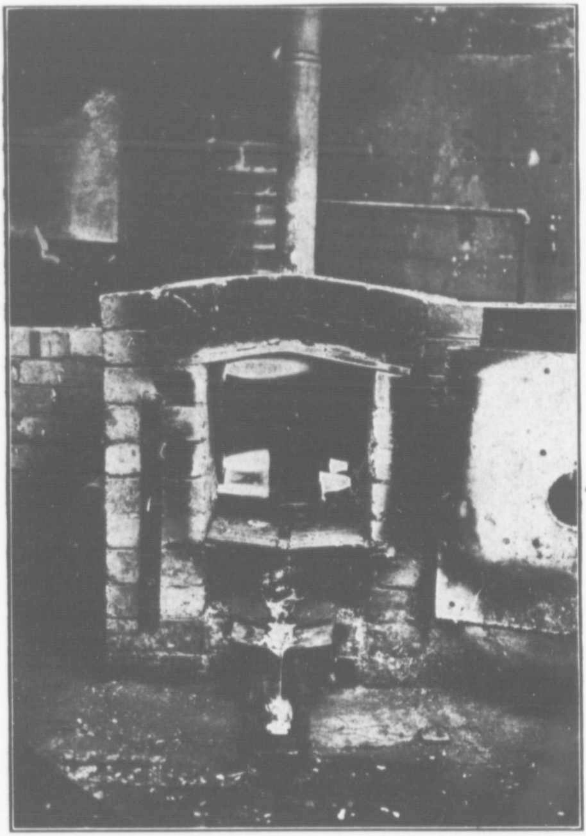
Three years ago the Chicago, Milwaukee & St. Paul Railway started a thorough test of motor cars to replace hand cars. The test was conducted on a division in Illinois consisting of 130 miles of double track. On this division from $8,000 to $10,000 a year is being saved by the use of these cars.

This saving has been accomplished in several ways. Length of sections have been increased, so that the expense of foremen was reduced one-third without reducing the efficiency of supervision. About one hour per day is saved in going to and from work; while in times of emergency the motor cars are valuable.

Giving Prices of Material to Foremen Increases Economy on Divisions.

Mr. E. R. Lewis, Division Engineer on the Michigan Central, Bay City, Mich., has adopted the following plan with the idea of providing each foreman with the prices of the materials used by him and introducing a healthy spirit of rivalry:

Each roadmaster is provided with a current price list of materials and tools, also with a supplementary sheet of units, weights, measures and costs designed to facilitate rapid calculations of prices of small materials usually quoted in hundred weights, tons, kegs or feet board measure. These price lists are altered or renewed from time to time to suit the market changes and new standards. Each roadmaster is also supplied with a copy of a monthly comparative report showing in detail the cost of maintenance of each mile of each section on the



RECLAIMING BABBITT METAL AT WORKS OF TORONTO STREET RAILWAY

entire division, the territory of each roadmaster being on a separate sheet, separately totaled and averaged. He thus obtains the actual comparative cost of maintenance of each mile of track under his own jurisdiction, and that of his fellow roadmasters for the foregoing month, in the following detailed order: Name of roadmaster; number of section; actual mileage of main, side, yard, industrial and other tracks, turnouts, switches and crossings in separate columns; number of miles of main track to which the total actual mileage of the section is equivalent; number of laborers employed; total cost of labor employed; cost of once-used material; cost of new material; cost of tools and equipment, including repairs; cost of track ties (separate account); cost of tie plates (separate account); total cost of labor and materials; total cost of each mile of main track or its equivalent; total of each of the foregoing items on all sections of each roadmaster's territory and average cost per mile of main track.

The increase in economy on the division during the operation the methods described have been in force, has been substantial.

ECONOMY IN THE OFFICE.

The efforts that railway managers are making to stop waste in small things as well as in great ones are illustrated by a circular entitled "Office Economies," which S. M. Felton, president of the Chicago Great Western, has sent to all office employees of this road. The circular, which has a sub-title, "How You Can Help Save the Pennies," is as follows:

Appeal having been made to employees in all other branches of the service for co-operation in the effort to reduce expenses, we reach one where the easiest and at the same time some of the greatest economies can be practiced. It has been demonstrated that by exercising judgment and care in the ordering and use of office stationery and supplies you can accomplish much toward the desired end. The items where savings can be effected may seem insignificant in themselves, but when considered in the aggregate they represent an annual amount equal to more than your month's salary.

A few suggestions along these lines are:

Letterheads—In addressing letters to various departments of the road if plain paper is used instead of printed letterheads a large reduction in printing bills will result.

Where a letter is spoiled before being completed, if the sheet of paper is laid aside and used as scratch paper instead of being thrown in the waste basket, the full value of using it will be obtained and less scratch paper will have to be ordered from the stationer.

Carbon Paper.—Experiments show that from one sheet of carbon paper one hundred legible copies can be made. Carbon paper deteriorates with exposure and the least possible number of sheets should be ordered at one time. Use each sheet until an equivalent of one hundred copies is made and you will obtain its maximum degree of service.

Rubber Bands and Erasers.—The price of rubber is continually increasing, and these articles represent the most expensive of office supplies. Do not waste rubber bands. An eraser fastened to your typewriter or desk by a cord (or rubber band to give elasticity) will not only be found to be a timesaver, but will prevent the possible actual loss of the eraser.

Envelopes.—Where more than one letter is sent to the same person each day an envelope should be addressed and left open until mailing time, so as to avoid using several envelopes for taking of mail that could be enclosed in one. Large envelopes cost more than small; and where a small envelope will answer it should be used, even though it is not on your desk. It will not take a minute's time to get one from your stationery supply. Always use manilla envelopes for company correspondence.

Postage Stamps.—Keep them under lock and key and use them only where the railway man will not serve the purpose. Stamps are the same as money, and should be used sparingly.

Pencils.—Use one pencil at a time. It is not necessary for stenographers to keep four or five pencils sharpened at once.

Empty Ink Bottles have a value. Return them to the stationer.

Telegraph Service.—There is a general idea that Western Union and Postal service costs the company nothing. This is not true. While we are allowed a certain number of free messages, all above that are charged for at regualr rates, and each year we are compelled to pay a considerable sum of excess telegraphing. Therefore, all messages sent via commercial lines should be carefully censored in order to reduce the number of words to a minimum. Messages sent over our own wires should be brief. Mail service should be used in preference to telegraph whenever possible to do so without detriment to the company's interest.

Wrapping Paper and Cord should not be wasted. Frequently they can be used a second or third time. By saving paper and cord from packages received in your office your requisitions for these articles will be very few.

Gas and Electric Light.—In these items a very large saving can be made. It is not necessary to turn on all lights at once; use only what are required, then turn them off when leaving the office or when you can see just as well without their use.

Drinking Water.—It is not furnished free of cost, as is generally supposed. It is aimed to supply the offices with the purest and freshest of water. When it is considered that several hundred gallons are used each month for drinking purposes, it can readily be seen that the cost is large. Draw only enough water at a time that will be consumed, and avoid throwing any on the floor or in the waste bucket.

Towel Service.—This is likewise an expensive item, and by being economical in the use of towels a considerable saving can be made.

Watch the little things, the big ones will take care of themselves. One hundred pennies make one dollar, and dollars saved are dollars earned. There are many ways in which you can earn your salary; let the economical use of the articles enumerated above be one of them.

REASONS FOR RESULTS.

On many railways, in many locomotive, car shops and engine houses economy is being practised and results are being obtained. Of course there is a reason for one shop being more economical than another. Fred G. Colvin says it is Personality, and he points to the plant of the Chicago & Northwestern Railway in Chicago, where repairs to locomotives and cars cost less than on any other road.

He says it isn't easy to discover the reason until the whole proposition is studied. Back of all the mechanical devices, back of system for keeping track of the work, is the personality of the man behind the gun. Coupled to this and in loyal co-operation with it, is the personality of his associates and the various foremen. Nor does it stop there, for all through the shop is the feeling of loyalty, resulting from a knowledge born of experience, that fair treatment is assured to every man in the plant.

While this may seem irrelevant, it is, I believe, the fundamental reason for the success of this plant. For, having secured the co-operation of the foreman and the men, the many time-saving devices came as a matter of course. These have made possible the handling of the material and the machinery and laying out of parts in such rapid time as to offset the handicap of an old shop.

Nor is this confined to the Chicago shops of the railroad. The same spirit extends all along the line. Meetings at headquarters of foremen of different departments bring out many good ideas, and some which cannot be adopted, but the general tendency is for a steady improvement of the methods and the time for doing the work. These meetings are held frequently, usually once a week at the Chicago shops, and help keep the interest alive and at work.

One of the methods used to increase production is the use of demonstrators in different departments, as well as a general demonstrator, who keeps a general oversight of the work so as to devise new methods and to encourage suggestions from all sources.

And every man gets credit for his suggestion, so that he is encouraged to further effort, instead of having his ideas claimed by someone who wants to make a showing.

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STOPPING SMALL LEAKS.

One of the reasons for the economical showing made by the Chicago & Northwestern Railway is the attention to the stopping of small leaks, because in the aggregate they foot up to an astonishing total.

One of these leaks is that of a manufactured material, such as bolts, nuts, washers, and the like. The all too common plan of allowing these to decorate the landscape around railroad yards is not in evidence here. Attention is called to a clear but considerate manner to the cost of bolts and nuts; to the cost of hauling them from the main shops to the point in question; and to the fact that a few wasted nuts counteract the revenue from several tons of freight hauled one mile (or the ton-miles); and similar information and suggestions are constantly being given.

Scrap bins very frequently reveal many pieces which are perfect or which require but little repairing. And where repairs are needed, they could often be made for less cost at the local shop than to ship to headquarters. For, while it is easier to pass it on to the central shop, and it is just possible that the repairs themselves could be done there for a few cents less money owing to their better facilities, the cost of transportation and handling in the main shop can easily make it cost more. It costs just as much to haul a car of scrap or repairs as a car of paying freight, and it also prevents the hauling of that much paying freight, providing it is there to be hauled.

These are all points which must be determined by the man in charge, and upon his judgment depends the saving or the expense. But it seems to be a case where a hard and fast rule is out of the question.

I trust that these few suggestions on "Cutting Out the Leaks in Railway Work" will result in the search for and adoption of methods which will mean great savings when put into practice. If I have led one official of a Canadian railway to take a renewed interest in the scientific or efficient principles of management, I shall be amply repaid for the work and time spent in compiling this paper.

Chairman,—

I am sure we have listened with a great deal of interest to this very interesting paper, and I will ask Mr. Herriot for his views on the matter, as he has had a great deal of experience both with railroad and factory practices.

Mr. Herriot,—

I think this paper has very thoroughly covered the ground. I ran across the following in the "Railway Storekeeper," the official magazine of the Railway Storekeepers' Association, which I think is very applicable to this subject, and I will read it to you:

CONSERVATION.

Casey, the storehouse foreman, explains a few things to Dugan, the drayman.

"Casey, Oi'm lost entoirely on some of the talk around the shops, and some of the wur-rds the bhoys be saying Oi don't understhand at all, at all. Some of thim was just talking about a pa-aper on the conversation of waste. Now what's that Casey?"

"You're wrong, as usual, Dugan. Oi read the artickle and it's conservation and not conversation. Conservation means saving."

"Well, Casey, does he mean cotton or wool waste?"

"There you go agin, Dugan; he refers to all the scrap and material which is not used. You should save it all and use it over agin."

"Oi see, Casey, that is, if we would use all the waste that we now waste there would be no waste wasted."

"You have it right, Dugan, now what else bothers you?"

"Well, Casey, what is this e-fishency and e-cononomy we hear bout so much now?"

"Well, Dugan, Oi'll endiver to explain it to you. E-fishency means doing things right, so nobody can find fault with the way they're done, and e-conomy means not going to any onnississary expense in doing them. E-fishency and e-conomy should walk hand in hand and pull together. If wan of thim gets crippled, you can see the other wan has to pull both loads. E-fishency without e-conomy is bad, Dugan, and versy visey. If e-conomy becomes a tight wad intoirely, e-fishency gets the wor-rst of it, and sometimes is too crippled aven to wal-lk on crutches. Do you follow me, Dugan?"

"Yis, but this tur-rible e-conomy is discour-raging whin you are expecting a r-raise in salary."

"You're r-roight, Dugan, but you know that 'sometimes what we git is what we least expect the most.'"

"Well, wan more question. Casey, who is this Gineral Stringincy the boss is talking about?"

"Well, Dugan, it is the common suspicion at the prisint toime, that he's the fa-ather of this same e-conomy we've mintioned, and Dugan, from what iverybody says about him, Oi think Oi could give his pidigree for wan gineration back on his mother's side, but Oi hisitate to use such langwidge."

"Don't say it, Casey, Oi understhand you."

The title of the paper "Stopping Leaks in Railroad Work," applies equally as well, as the reader has said, to the manufacturing plants of our country.

In the plant I am connected with, the system as laid out in this paper is practically in force. All cast iron scrap which accumulates is remelted in our foundry, scrap steel, wrought iron, cast and steel turnings and borings are all classified and disposed of to dealers in this class of material. Scrap brass is handled in the same manner. Brass turnings from the brass finishing department is passed through a magnetic cleaning machine, which removes all iron and other metals, and is either remelted or sold. The refuse or "tailings" from this machine is also marketable. Scrap rubber packing, old hose, etc., is segregated and sold. Empty barrels of all kinds, as you are aware, are returned to vendors who allow proper credits. Any headless barrels can be disposed of to dealers in scrap material.

In the store receiving room, boxes, etc., are opened with a nail puller, thereby saving the box and nails which are used by the shippers when shipping material away.

With regard to economy in office supplies. The use of envelopes is heavy in a plant where there is a large number of departments, and the following plan saves a large number:

When sending a letter to another department, I enclose the communication in an envelope, and instead of sealing same turn the flap inside, then turning the envelope write the address across the end. The person receiving same, instead of destroying envelope, simply crosses off his name and readdresses. Envelopes can be used as long as there is room to write on same.

I do not think that there is anything more that I can say on this subject, except that I am pleased to have listened to this paper. Personally it has been of great interest, containing, as it does, very many valuable hints which will be useful in my business.

Mr. Wickens,—

This is a subject that impresses itself very much on any man who has travelled over our Canadian railways, and has seen the vast amount of loose material lying alongside the tracks of our railways.

A few days ago I happened to be going to Guelph; as we pulled out of the station I noticed four or five big chunks of coal that had fallen off the tender of an engine and it was evident that the tender must have been overloaded. This made me think of the stopping of small leaks, and I paid particular attention to this and noticed a large number of chunks partly buried in the earth, and I am quite positive that there were several tons of coal lying along the track. This was especially so at curves, where it seemed to me that with the swinging of the tender around the curves the coal rolled off in large quantities. I think that there should be some person to see that firemen do not overload their tenders. Of course, possibly the firemen are afraid that they might run short of coal, but it seems to me that a waste of this kind should be looked after.

I have been called in many times to large manufacturing institutions to look for leaks. There are small leaks in all of them. One of the difficulties that the larger factories have to contend with, excepting those with very modern equipment, is that they have been built too cheap. They were looking for the cheapest type of plant they could find, but lately the larger factories have engaged some competent engineer to lay out their plant. They have spent more money in the initial cost and consequently have reduced the maintenance cost.

A little while ago I was talking to an organization about wasting heat, but before talking to them I thought I would run some experiments to get the facts. The experiments were very simple, and the results obtained I worked out to show the loss in dollars and cents per year, and I prepared a small pamphlet, the portions of which, relative to this subject, I will read to you.

1. The loss to you in money from uncovered steam pipes.

A steam pipe 3 inches in diameter, carrying 100 lbs. steam pressure, will condense 1 lb. of steam per hour for each square foot of its surface. If it is 30 feet from the boiler to the engine, and the pipe is 3 inches in diameter, it will condense 20 lbs. per hour. If you are running 10 hours per day, steam will be on the pipe at least 12 hours. This means 240 lbs. per day, and for 300 days is 72,000 lbs. of steam condensed. If the boiler is well set and well fired, it may evaporate 7 lbs. of water with 1 lb. of coal. This is equal to $5\frac{1}{4}$ tons of coal, and at $4.00 per ton is $21.00.

2. The loss to you from leaking safety valves and flange joints "blowing."

We also see very many safety valves leaking or flange joints blowing a little. These are small leaks, but will amount to dollars during the year. A round hole 1|16 inch in diameter has an area of .00307 of a square inch. This seems like a very small opening, and it is small—but this small hole will discharge .307 of 1 lb. per minute, or 221 lbs. in 12 hours, and amounts in a year to 66,300 lbs. of water or steam; and upon a basis of 7 lbs. water evaporated with 1 lb. coal, it represents a cash leak of $18.94 per year.

In steam plants where only 5 lbs. of water are evaporated by 1 lb. of coal, 25% should be added to these amounts.

3. The loss to you from blow-off cocks, try-cocks, or even the pet-cock of water gauge.

A drip, drip, drip from a blow-off cock or from the try-cocks, or the pet-cock at the bottom of a glass water-gauge, will allow 150 lbs. of water to pass in 24 hours. This amounts to 45,000 lbs. of water per year, representing 6,425 lbs. of coal, and a cash value of $12.35.

4. The loss to you from blow-off valves leaking, gauge-cocks, glass water-gauge, and leaks at flanges.

We often see a blow-off valve leaking, one or more gauge-cocks, the glass water-gauge, and several steam leaks at flanges, or joints all going at once—and while each of these leaks are small, added together they make a substantial cash loss. These losses are all of such a character that any engineer can stop them at a cost so small that it would never be noticed.

And any engineer who allows such leaks continually should be driving a wheel-barrow instead of an engine.

I think this paper will start everybody thinking about how to stop small leaks.

Money is no good to you if you do not save some of it, and if you do not stop it leaking away, when you get old you will have nothing for yourself in your old age, and the same principle applies to business. No business can prosper if there are too many small leaks.

Mr. Lewkowicz,—

One or two of the remarks made have impressed themselves on me, one of them being made by Mr. Wickens regarding waste of fuel on locomotives.

It is a matter of record that some continental railway companies have made it a practice to give premiums or prizes to drivers and firemen using the least amount of coal per month to run their locomotives, with the result that they have got it down so accurately that they sometimes go into a roundhouse with hardly enough steam to move the engine, in fact they have to be assisted in on some occasions.

In the matter of office economy, that is out of my province. No doubt those leaks are somewhat similar to the leaky pet-cock mentioned by the previous speaker.

The statement, read from the paper, that impressed itself on me was the matter of saving, given in dollars and cents, on the installation, in power plants, of labor saving devices for handling coal, ashes and such like material, with conveyors, overhead bins and chutes down to the boilers which practically reduces the labor of the fireman to shovelling coal into boilers or attending to automatic stokers. There is no doubt this is the greatest field for economy, and by the introduction of mechanically worked installations of labor saving devices large leaks are stopped.

Mr. Jefferis,—

In moving a vote of thanks to the reader of this paper, there are one or two things I might mention.

You have been talking about small leaks and drops of water, that is all right, but the statement that the big things will take care of themselves, I question.

True economy requires a lot of practical experience and sound judgment. Reducing the pay rolls is not always economy. The statement was made that the purchasing agent should get information from everybody using the material, if he does this, he will, I am afraid, be a very busy man. In large companies and systems we know he cannot do this.

It is in the first purchase of the larger installations that we want economy. I mean in knowing what you require and getting it; that is the key-note in engineering.

Two of the gentlemen that the reader spoke of, Mr. Felton I know personally, as I worked under him for three years, and Mr. Quayle of the Chicago & North Western R.R., was also mentioned. I wish to say that anything that was done by him is about right. I have the greatest respect for Mr. Quayle's engineering skill. I have known him for a great many years.

As the reader states, personality is a great factor in this matter, personality of the head of the department will extend all down the line and all through the departments.

The manager of a large contracting firm in the United States went to look over some large mills in New England in reference to putting in some labor-saving devices, such as the conveyors that Mr. Lewkowicz spoke about; he was awarded the contract and after the equipment was installed he was giving the manager some advice in reference to the installation, and among other things he advised the manager to get a competent engineer to take care of the equipment. He said, "There is about $250,000 worth of equipment here, and it will require a first class man to look after it."

"Oh, how much would that cost?"

"Well, I suppose you could get a fairly good man for about $2,000 or $3,000 a year and he would save you a great deal more than his salary."

"Why, you stated this was a labor saving installation. I don't see the necessity for getting a man like that," replied the manager. And he didn't get one.

The result was that in the course of a few months the firm had to send their staff over there to make the necessary repairs, and the manager said to me:

"Now, if I tell intending purchasers, whether it be companies or individuals, that after the installation has been put in it is going to cost so much for supervision and maintenance, I would not sell my goods."

The thought I am trying to bring out is, that the true economy is in starting the first installation right.

If Mr. Wickens was called by a firm who wanted to install a plant they would tell him what horse power they consider they would require, and after looking the situation over he quoted them a figure that would cover the installation of a first class plant they would probably turn him down, stating that they expected to do it for half of the money.

True economy commences right at the beginning with the big things. There are a great many men we all know who will quibble and investigate any small items that come to their notice, but a bill for $10,000 or $20,000 or $50,000 is passed right off the reel without much investigation, and this is really the account that should be thoroughly looked into, and if it were done many thousands of dollars would be saved each year.

Another point is loyalty. There are a great many men working for large corporations where material is plentiful who go along in a matter-of-fact way and waste a great deal, when in reality they are just as much responsible for the material they are wasting as if it were their own. On the other hand there are a great many men in American and Canadian companies who have charge of the different equipment who we never hear about or see unless we happen to go over their plant. They are watching everything quietly, they have their finger on the pulse and are using the best judgment consistent with their environments to efficiently and economically handle their department, and they are managing it as well as it could be done by anyone, but there are hundreds of these men we never hear of.

The gentleman who wrote this paper had a very large subject to handle, and one on which we could go on talking all night. Personally I take a great deal of pleasure in moving Mr. Armer and Mr. Keith a very hearty vote of thanks.

Mr. Lewkowicz,—

I will second that vote of thanks.

Chairman,—

It has been regularly moved and seconded that the hearty vote of thanks of this meeting be tendered to Mr. Keith for reading this paper, and Mr. Armer for writing it. What is your pleasure? Carried unanimously.

Chairman,—

Mr. Keith, I have great pleasure in tendering Mr. Armer and yourself the hearty vote of thanks of this meeting for the excellent paper which you have given us to-night.

Mr. Keith,—

I wish to cordially thank this meeting for the vote of thanks which I will pass along to Mr. Armer. I am very sorry that he is not here to speak for himself, as I am sure that he would have added something to the discussion as well as to the paper itself.

It has been my good fortune to be connected with the construction of two large plants. In installing the new machinery we bought it from the standpoint of efficiency. Economy in handling material to save waste through spoiling parts or losing same was another feature. Take for instance, the operations of screwing and tapping bolts and nuts. The blanks for the nuts were bought, the bolts were made in the forge shop. These were turned into stock and counted, they were then taken from stock in certain numbers to be machined, and that same number had to be returned to stock. When they were required for use in construction a requisition had to be made out for them. We found that this system of eliminating waste and with the new machinery that we were able to produce them at 33⅓% less than we were producing them for before.

In railroad work, take the welding of tubes. It is not more than two years ago that they were doing 100 a day, but now with an oil furnace and a pneumatic welding machine, they can turn out 600 a day and more. This shows the elimination of waste time.

Mr. Herriot referred to the recovering of brass scrap, etc., by means of a magnet. Another method is with a new brass furnace into which all the sweepings off the floor are put, and by this means they recover all the brass that might be otherwise swept away. An installation such as this has been successfully used by the Brown Machinery Co., New Glasgow, N.S.

I am quite sure that if a little more time was given by purchasers to the efficiency of the machinery, and they would give a little less attention to the initial price, they would find their installations much cheaper in the end.

Chairman,—

The next order of business is the election of officers for the year 1912. As you are all aware, the Nominating Committee was appointed by yourselves at the last meeting to nominate the officers for the year 1912, and I feel safe in saying that it is almost impossible to pick out a more efficient set of officers than those nominated by this Committee. As you all have a copy of the voting paper you can see what selections were made.

At that meeting I made the suggestion that Mr. Patterson the Master Mechanic of the G.T. Ry. Shops at Stratford, who has been of great assistance to this Club in the past, and will, I do not doubt, continue to assist it in the future. He has not only given us two papers, but has given us a lot of advice that has materially assisted our Secretary, and the suggestion I made was, that Mr. Patterson be made Honorary President. This is a new position, but I feel assured in saying that it will meet with the approval of the members.

It was moved by Mr. Wickens, and seconded by Mr. Bannon, that Mr. Patterson, Master Mechanic of the G.T. Ry. Shops at Stratford, be appointed Honorary President of this Club, which was carried unanimously.

Chairman,—

While it has been a rule in the past for the Nominating Committee to select what they consider the best men to fill the offices for the ensuing year and to present same at the December meeting, it does not follow that this list is final. I wish to state that it is the privilege of any of the members present to-night to nominate anyone else they wish for any office, and if there are any further nominations, they will be added to the list in your hands, and voted upon.

Mr. Fletcher,—

I do not see that we can do any better than adopt the suggestion made by the Nominating Committee, and I therefore move that the recommendation of the Nominating Committee be adopted as a whole.

Mr. Lewkowicz,—

I take pleasure in seconding that motion.

Chairman,—

It has been regularly moved by Mr. Fletcher, and seconded by Mr. Lewkowicz, that the nominations of the Nominating Committee be accepted as a whole. What is your pleasure? Carried unanimously.

The following officers were elected for the year 1912:—

PRESIDENT

J. Bannon, Chief Engineer, City Hall, Toronto.

FIRST VICE-PRESIDENT

A. Taylor, Foreman Boilershop, Polson Iron Works, Toronto

SECOND VICE-PRESIDENT

E. Logan, Foreman, G.T.R. Shops, Toronto.

EXECUTIVE COMMITTEE

A. M. Wickens, Executive Special, Canadian Casualty & Boiler Insurance Co., Toronto.

J. Herriot, General Storekeeper, Canada Foundry Co., Toronto.

C. G. Herring, Chief Draughtsman, Consumers' Gas Co., Toronto.

T. Walsh, Chief Engineer, High Level Pumping Station, Toronto.

C. D. Scott, Representative, Gutta Percha Rubber Co., Toronto.

W. C. Sealy, General Foreman, G.T.R., Toronto.

A. J. Lewkowicz, Consulting Engineer, Toronto.

AUDITORS

D. Campbell, Storeman, Consumers' Gas Co., Toronto.

A. W. Durnan, Representative, Rice Lewis & Son, Toronto.

RECEPTION COMMITTEE

H. G. Fletcher, J. F. Campbell, A. W. Carmichael, A. W. Durnan, H. Ellis, J. H. Morrison, W. R. Gardner, R. Pearson, E. A. Wilkinson, Jas. Wright, W. Newman, C. L. Wilson, W. E. Cane, W. McRobert, H. Cowan.

Mr. Lewkowicz,—

I think we are entitled to a few remarks from our President elect. We would like to know what he is going to do for us next year.

Mr. Bannon,—

Mr. Chairman, and members of this Club. I feel very grateful indeed that you have seen fit to honor me by electing me President of this Club for the year 1912. This is an honor which comes to a man only once in a lifetime. The Club in the past has been extremely fortunate in its selection of the President, and I feel somewhat diffident when I remember that I have to follow such men as Mr. Jefferis, and our esteemed President, Mr. Baldwin.

Those who know me on the Executive Committee know my views on the matter of the election of officers, which I consider should be done entirely by the members present at the December meeting; however, as this is the Club's way of electing its officers, and as you chose your Nominating Committee, I am entirely in your hands.

I can assure you that I shall devote my time to try and improve everything in connection with the Club during the coming year.

One change I have in mind is to try and get a home for ourselves so that this Club will be a permanent organization, and I think that something might be done during the ensuing year to accomplish this object.

I have nothing more to say other than to thank you once more, and I will do all I possibly can to advance the interests of the Club.

Chairman,—

The next paper will be on "Modern Steam Power Plant and Its Appliances," by Mr. J. Kastella, Chief Engineer of the Power Plant at the G.T.R. Shops, Stratford, and the paper for February will be given by Mr. Wickens, on "Soft Coal and a Smoky City." You will see that we have two very interesting papers ahead of us.

I think Mr. Herriot has something to say under the head of General Business.

Mr. Herriot,—

Under the head of General Business I would like to bring before the members the matter of the donation to charity that we made last year. As this is the season of the year when we all have that feeling of good fellowship to all men.

After some discussion the following resolution was carried unanimously.

Proposed by Mr. Herriot, seconded by Mr. Jefferis, that the Executive Committee distribute the sum of $100.00 or more, at their discretion, amongst the various charitable organizations of the city.

Proposed by Mr. Fletcher, and seconded by Mr. Dewar, that the meeting be adjourned.

At a meeting of the Executive Committee, it was decided that the sum of $120.00 be divided amongst the following institutions. A list of the institutions and the amount donated to each is given below:

Boys' Home, Toronto	$10 00
Infants' Home and Infirmary, Toronto	10.00

Children's Aid Society, Toronto	$5.00
Sacred Heart Orphanage, Sunnyside, Toronto	10.00
House of Industry, Toronto	5.00
House of Providence, Toronto	5.00
Hospital for Incurables, Toronto	10.00
Muskoka Free Hospital, Toronto	5.00
Hospital for Consumptives, Weston	5.00
Girls' Home, Toronto	5.00
Toronto Hospital for Sick Children, Toronto	5.00
East End Day Nursery, Toronto	10.00
Home for Incurable Children, Toronto	10.00
Aged Women's Home, Toronto	5.00
Aged Men's Home, Toronto	5.00
Children's Home, Toronto	5.00
The "Star" Santa Claus Fund, Toronto	10.00

LIST OF MEMBERS.

A. W. Adams, Sales Manager, The Allen & Morrison Brake Shoe Manufacturing Co., Chicago, Ill.

J. R. Armer, Machinist, G.T.R., Battle Creek, Mich.

W. E. Archer, Chief Engineer, Nasmith Co., Limited, Toronto.

J. C. Armer, Manager, *Railway Journal*, Toronto.

A. Attle, Machinist, G.T.R., Toronto.

W. H. Alderson, Gutta Percha Rubber Co., Toronto.

E. C. Adams, Manager, Anchor Packing Co., Detroit, Mich.

H. C. Austen, Representative, Dunlop Tire Rubber Goods Co., Limited, Toronto.

S. H. Allen, Standard Bank, Toronto.

F. Atwater, Treasurer, Columbia Nut & Bolt Co., Bridgeport Conn.

G. T. Allen, Manager, Hoyt Metal Co., Toronto.

H. V. Armitage, Foreman, Chapman Double Ball Bearing Co., Toronto.

J. F. Alexander, Local Manager, Babcock & Wilcox, Limited, Toronto.

John Adam, Clerk, Stores Dept., Polsons Iron Works Limited, Toronto.

J. A. W. Archer, Manager, Archer & Gerow, Toronto.

E. B. Allen, Sales Engineer, Allis-Chalmers-Bullock, Co. Toronto.

W. G. Adams, Representative Frank Williams & Co., Davisville P.O., Ont.

F. Adams, Engineer, G.T.R., Stratford, Ont.

W. E. Adams, Shipper, Structural Dept., Canada Foundry Co., Toronto.

A. A. Allen, Manager, Holden Co., Montreal, Que.

J. S. Adam, Fitter, Pipe Foundry, Canada Foundry Co., Toronto.

W. Allen, Engineer, Consumers' Gas Co., Toronto.

M. Le C. Atkinson, Toronto.

J. Anderson, Clerk, G.T.R., Toronto.

J. Anderson, Marine Engineer, East Toronto.

J. W. Aston, Chief Engineer, Toronto Ferry Co., Toronto.

W. H. Bowie, Mechanical Expert, New York.

G. Baldwin, General Yard Master, Canada Foundry Co., Toronto.

Acton Burrows, Managing-Director, *Railway & Marine World*, Toronto.

H. Bertram, Secretary, The John Bertram & Sons Co., Dundas, Ont.

F. G. Butterfield, Butterfield & Co., Rock Island, Que.

G. Black, Road Foreman, G.T.R., Stratford, Ont.

G. Bernard, Mechanical Inspector, Canadian Inspection Co., Toronto.

A. M. Burwell, Engineer, G.T.R., Mimico.

J. Beck, Superintendent, Union Station, Toronto.

H. H. Beasley, Storekeeper, Toronto Railway Co., Toronto.

G. D. Bly, Manager, Monarch Supply Co., Toronto.

J. Bannon, Chief Engineer, City Hall, Toronto.

J. Barker, Ex-Machinist, G.T.R., Toronto.

A. B. Brown, Canadian Representative, Canadian Westinghouse Co., Montreal, Que.

C. Bugg, General Foreman, Bridge & Building Dept., G.T.R. Stratford, Ont.

C. G. Bowker, Superintendent, G.T.R., St. Thomas, Ont.

W. J. Bird, National Iron Works, Toronto.

T. T. Black, Civil Engineer, Canada Foundry Co., Toronto.

G. Battley, Engineer, G.T.R., Stratford, Ont.

F. Brodie, Assistant Foreman, Canada Foundry Co., Toronto.

H. H. Brewer, General Superintendent, G.T.P. Ry., Winnipeg, Man.

E. Blackstone, Machinist, G.T.R., Toronto.

J. C. Brady, Mechanical Engineer, Goldeneast, Kootenay, B.C.

C. L. Bailey, Canadian Manager, William Jessop & Sons, Limited, Toronto.

F. W. Burrows, Representative, Imperial Accident Guarantee Co., Toronto.

E. R. Battley, Locomotive Foreman, G.T.R., Fort Erie, Ont.

R. H. Brown, Brass Finisher, C.P.R., Toronto.

O. A. Burt, Fitter, C.P.R., West Toronto.

P. Brundrett, Assistant Foreman, Pipe Foundry, Canada Foundry Co., Toronto.

C. H. Bull, Machinist, Canadian Pacific Railway, West Toronto.

G. H. Boyd, Foundry Cost Clerk, Canada Foundry Co., Toronto.

F. W. Barron, Chief Engineer, Copeland Brewing Co., Toronto.

G. S. Browne, Fitter, C.P.R., West Toronto.

A. E. Baines, Machinist, G.T.R., Stratford, Ont.

G. Blyth, Engineer, Chapman Double Ball Bearing Co., Toronto.

S. Best, Machinist, G.T.R., Toronto.

A. T. Bliss, Machinist, G.T.R. Toronto.

P. Brazier, Boilermaker, G.T.R., Stratford.

J. L. Bigley, R. Bigley Manufacturing Co., Toronto.

R. Burns, Superintendent, Philip Carey Manufacturing Co., Toronto.

F. Bastow, Gentleman, Toronto.

G. P. Beswick, Clerk, Polson Iron Works Limited, Toronto.

J. W. Blair, Manufacturers' Agent, Toronto.

J. Burns, Burns Coal Co., Toronto.

V. Baker, Civil Engineer, Parker Russel Mining & Manufacturing Co., St. Louis, Mo.

F. Burnett, Gas Engineer, Economical Gas Apparatus Co., Toronto.

H. Biffin, Iron Worker, Consumers' Gas Co., Toronto.

J. H. Branston, Machinist Improver, G.T.R., Stratford, Ont.

F. Branston, Machinist Apprentice G.T.R., Stratford, Ont.

T. H. Barnes, Salesman, H. W. Johns-Manville Co., Toronto.

P. Bain, Editor, *Marine Engineering of Canada*, Toronto.

R. W. Bennett, Conductor, G.T.R., Hamilton, Ont.

J. M. Beswick, Bookkeeper, Standard Foundry Co., Toronto.

G. Beck, Machinist, Gurney Foundry Co., Toronto.

D. Campbell, Storeman, Consumers' Gas Co., Toronto.

K. D. Clarke, Representative Harbison Walker Refractories, Limited, Buffalo, N.Y.

G. Cooper, Road Foreman, G.T.R., Hamilton, Ont.

W. Carter, Salesman, Winnipeg, Man.

H. Cowan, Foreman, Motor Shops, Toronto Railway Co., Toronto.

J. M. Clement, Foreman Fitter, Boiler Dept., Canada Foundry Co., Toronto.

O. A. Cole, Manager, Crown Gypsum Co., Toronto.

S. Crossley, Dining Car Conductor, G.T.R., Toronto.

W. B. Cookson, Representative, Imperial Varnish & Color Co., Toronto.

W. H. Chidley, Locomotive Inspector, G.T.R., Stratford, Ont.

J. F. Campbell, Representative, Elaterite Paint Co., Toronto.

W. S. Cowan, Foreman Driller, Canada Foundry Co., Toronto.

H. Cross, Blacksmith, Consumers' Gas Co., Toronto.

W. E. Cane, Representative, M. Leith & Co., Toronto.

B. W. Coghlin, Manufacturer of Railway Spring & Truck Tools, Montreal, Que.

A. W. Carmichael, Representative, Canadian Supply Co., Toronto.

G. Cook, Engineer, Consumers' Gas Co., Toronto.

F. Clement, Conductor, G.T.R., Sarnia, Ont.

H. J. Carruthers, Engineer, G.T.R., Sarnia, Ont.

W. J. Commins, Manager, Roofing Dept., H. W. Johns-Manville Co., Toronto.

W. A. Chapman, Manager, Rail Joint Co. of Canada, Montreal, Que.

J. Cave, Chief Electrician, Canada Foundry Co., Toronto.

B. Clark, National Iron Works, Toronto.

R. M. Carmichael, Engineer, C.N.O. Ry., Toronto.

J. Craig, General Superintendent, Canada Foundry Co., Limited, Toronto.

F. A. Corns, Principal, Dominion Engineering Academy, Toronto.

A. T. Cowpersmith, Engineer, Consumers' Gas Co., Toronto.

C. Chappelle, Apprentice, G.T.R., Toronto.

G. F. Clark, Machinist, Consumers' Gas Co., Toronto.

A. Chenoweth, Machinist, G.T.R., Stratford, Ont.

W. A. Conroy, Fitter, C.P.R., West Toronto.

D. Cairns, Draughtsman, Consumers' Gas Co., Toronto.

S. Cowan, Machinist, Chapman Double Ball Bearing Co., Toronto.

J. J. Conlin, Engineer, S.S. "Kingston," R. & O. Navigation Co., Toronto.

T. B. Cole, Engineer, Christie Brown Co., Toronto.

W. H. Church, Foreman, Pipe Shop, Canada Foundry Co., Limited, Toronto.

E. E. Cummings, Factory Manager, S. R. Bowser & Co., Toronto.

K. H. Cox, Engineer, Gurney Foundry Co., Toronto.

J. G. Corlett, Assistant Foreman Erector, Canada Foundry Co., Toronto.

G. Carter, Steam Fitter, Consumers' Gas Co., Toronto.

G. H. Carman, Foreman Carpenter, Consumers' Gas Co., Toronto.

C. O. H. Craigie, Secretary Treasurer, Canadian Automatic Transportation Co., Toronto.

J. Chipchase, Manager, Supply Department, Canadian Fairbanks Co., Toronto.

H. Clay, Engineer, G.T.R., Stratford, Ont.

R. Coxon, Machinist, Gurney Foundry Co., Toronto.

H. H. Cheesman, Ship Draftsman, Polsons Iron Works Limited, Toronto.

J. R. Donnelly, Master Mechanic, G.T.R., Allandale, Ont.

A. W. Durnan, Rice Lewis & Son, Toronto.

J. Duguid, Master Mechanic, G.T.R., Montreal.

D. A. Dickson, Chief Engineer, Temple Building, Toronto.

J. Dodds, Government Steamboat Inspector, Toronto.

W. Dyer, Engineer, G.T.R., Stratford, Ont.

J. M. Downer, Downer Pattern Works, Toronto.

W. E. David, Machinist, Consumers' Gas Co., Toronto.

J. Dewsbury, Machinist, G.T.R., Toronto.

C. L. Drury, Representative, Drury Iron & Steel Co., Toronto.

F. D. Dewar, Toronto.

C. Daniel, Foreman, Moulding Shop, Canada Foundry Co., Toronto.

J. C. Donald, Foreman Carpenter, Canada Foundry Co., Toronto.

F. H. Dence, Traveller, Canadian Fairbanks Co., Toronto.

W. Dony, Machinist, G.T.R., Toronto.

G. H. Dyer, Proprietor, Brighton Laundry Co., Toronto.

S. G. Dabner, Machinist, Canada Foundry Co., Toronto.

J. S. N. Dougall, President, The Dougall Varnish Co., Limited, Montreal.

L. Davidson, Machinist, G.T.R., Toronto.

G. Despond, Manager, Standard Foundry, Toronto.

G. Dingwall, Representative, Philip Carey Manufacturing Co., Toronto.

J. B. Dunlop, Machinist Improver, G.T.R., Stratford, Ont.

W. S. Davis, Foreman, G.T.R. Shops, Stratford, Ont.

W. Demmett, Engineer, Toronto.

B. Dillon, Machinist's Improver, G.T.R., Stratford, Ont.

T. Dudgeon, Machinist, Chapman Double Ball Bearing Co., Toronto.

J. Douglas, Foreman Molder, Gurney Foundry Co., Toronto.

H. H. Dryden, Canadian Oil Co., Toronto.

J. Disney, Representative, F. Hyde & Co., Montreal, Que.

F. W. Donaldson, Boiler Inspector, Toronto.

W. H. N. Davis, Representative, Garlock Packing Co., Toronto.

J. A. Dickinson, Clerk, Polson Iron Works Limited, Toronto.

H. O. Eddrup, Clerk, G.T.R., Toronto.

H. Ellis, Foreman, Machine Shop, Consumers' Gas Co., Toronto.

G. E. Evans, Resident Engineer, Dominion Bridge Co., Toronto.

W. Evans, Government Steamboat Inspector, Toronto.

H. Eatherley, Machinist, Bawden Machine Tool Co.,Toronto

C. Endinger, Steel Structure Inspector, Canton, Ohio.

R. C. Fisher, Manager, Rice Lewis & Son, Limited, Toronto.

J. J. Fletcher, Chattanooga, Tenn.

F. S. Ferguson, Local Superintendent, Canada Iron Corporation, Limited, St. Thomas.

J. J. Fisher, Engineer, G.T.R., Sarnia, Ont.

H. G. Fletcher, Representative Garlock Packing Co., Toronto.

W. Fisk, Machinist, Gurney Foundry Co., Toronto.

R. H. Frees, Manager, Malleable Iron Co., Walkerville, Ont.

W. H. Farrell, Terminal Superintendent, G.T.R., Toronto.

R. H. Fish, Road Foreman, G.T.R., London, Ont.

J. T. Fellows, Draughtsman, Consumers' Gas Co., Toronto.

E. J. Friend, Engineer, Canada Foundry Co., Toronto.

A. Fraser, Foreman Drillhand, Chapman Double Ball Bearing Co., Toronto.

J. Fraser, Machinist, G.T.R., Stratford, Ont.

E. G. E. Ffolkes, Wilkinson Plough Co., Toronto.

M. Foy, Chief Engineer, Toronto Cold Storage Co., Toronto.

I. O. Frost, Carpenter, G.T.P.R., Elm Park P.O., Alberta.

J. H. Fryer, Managing Director, Galt Malleable Iron Co., Galt, Ont.

J. Fleck, Insurance Engineer, Toronto.

W. Forbes, Builder, Toronto.

P. H. Fox, Chief Despatcher, C.N.O. Ry., Toronto.

J. A. Findlay, Marine Engineer, Toronto.

R. Graham, Mechanical Engineer, Toronto.

J. S. Gray, Foreman Machinist, Polson Iron Works Limited, Toronto.

W. J. George, Engineer, G.T.R., New Toronto.

J. C. Garden, Master Mechanic, G.T.R., Battle Creek, Mich.

R. W. Grace, General Superintendent, Flat Iron Works, Dayton, Ohio.

E. Garrigan, Foreman, Structural Department, Canada Foundry Co., Toronto.

W. H. Ginder, President, Ontario Lantern & Lamp Co., Hamilton, Ont.

U. E. Gillen, Superintendent, G.T.R., Toronto.

J. W. Griffin, Motor Shops, Toronto Railway Co., Toronto.

J. C. Grant, Representative, B. F. Sturtevant Co., Toronto.

M. R. Griffiths, Manager, H. W. Johns-Manville Co., Toronto.

J. C. Gartshore, Railway Equipment, Toronto.

A. W. Givin, Toronto.

C. H. De Gruchy, Representative, Finley-Smith Co., Toronto.

C. Geldart, Foreman, Machine Shop, G.T.R., Stratford, Ont.

E. B. Gilmour, Molding Expert, Toronto.

G. S. Grassick, Salesman, Consumers' Gas Co., Toronto.

W. R. Gardner, Engineer, C. & W. Walker Co., (England), Toronto.

J. Greville, Apprentice, G.T.R., Toronto.

T. E. Greenshields, Machinist, G.T.R., Toronto.

E. S. T. Gerow, Manager, Archer & Gerow, Toronto.

A. A. Gardner, C. & W. Walker Co. (England), Toronto.

R. A. Girouard, Civil Engineer, Toronto.

W. A. Grocock, Engineer's Representative, Toronto.

T. Graham, Assistant Engineer, City Hall, Toronto.

W. W. Garton, Machinist, Christie Brown Co., Toronto.

T. F. Garrigan, Assistant Superintendent, Bridge Department, Canada Foundry Co., Toronto.

J. C. Grant, Foreman, Erection Department, Canada Foundry Co., Toronto.

J. N. Gregory, Manager, Dearborn Drug & Chemical Works, Buffalo, N.Y.

H. Goods, Foreman, John Inglis Co., Toronto.

W. R. Glasgow, Manager, Canadian Steel Foundries, Welland, Ont.

Jos. Haines, D. K. McLaren Co., Toronto.

J. E. Houghton, Chief Operator, G.T.R., Toronto.

J. W. Harkom, Consulting Engineer, Melbourne, Que.

G. W. Hardy, Engineer, G.T.R., Sarnia Tunnel.

Hannibal, Green's Sons & Co., Troy, New York.

J. Herriot, General Storekeeper, Canada Foundry Co., Toronto.

J. G. Hyde, Machinist, G.T.R., Toronto.

A. D. Homard, Travelling Engineer, Detroit Lubricator Co., Detroit, Mich.

D. C. Hallowell, Machinist, G.T.R., Toronto.

T. A. Hollinrake, Manager, A. R. Williams Machinery Co., Toronto.

J. Hay, Locomotive Foreman, G.T.R., Sarnia, Ont.

W. A. Hare, Standard Engineering Co., Toronto.

W. Hamilton, Cochrane, Ont.

A. E. Hawker, Mechanical Engineering, Toronto.

T. E. Hicks, Assistant Foreman, Bridge Dept., Canada Foundry Co., Toronto.

A. Hallimore, Machinist, G.T.R., Toronto.

W. D. Hall, Superintendent of Tunnel, G.T.R., Port Huron, Mich.

C. G. Herring, Chief Draughtsman, Consumers' Gas Co., Toronto.

H. O. R. Horwood, Leveller, Dominion Bridge Co., Toronto.

P. J. Harley, Machinist, G.T.R., Stratford, Ont.

M. C. J. Hockin, Representative, Chapman Roller Bearing Co., Toronto.

T. Henry, Chief Engineer, Erindale Power Co., Toronto.
W. Higgins, May-Oatway Fire Alarm Co., Toronto.
L. S. Hyde, Clerk, G.T.R., Toronto.
M. A. Humber, Apprentice Instructor, G.T.R., Stratford, Ont.
J. H. Hartley, Clerk, G.T.R., Toronto.
F. Hardisty, Engineer, G.T.R., Sarnia, Ont.
J.L. Hutcheson, Superintendent, Booth Copper Co., Toronto.
C. M. Henderson, Superintendent, Holden & Schofield Machine & Tool Co., Toronto.
M. B. Horan, Superintendent, Pipe Foundry, Canada Foundry Co., Toronto.
T. Honey, Fitter, Canada Foundry Co., Toronto.
J. Hughson, Representative, British-American Oil Co., Toronto.
W. J. Hayes, Engineer, G.T.R., Stratford, Ont.
J. J. Harris, Chief Engineer, O'Keefe Brewery Co., Toronto.
F. G. Herbert, Chemist, Canada Foundry Co., Toronto.
J. Hunt, Stationary Engineer, Consumers' Gas Co., Toronto.
F. H. Hawkins, Mechanic, Consumers' Gas Co., Toronto.
J. H. Holfelder, South Framingham, Mass.
J. W. Hetherington, Machinist, Canada Foundry Co., Toronto.
J. H. Hollingworth, Machinist, G.T.R., Stratford, Ont.
W. Hebdon, Machinist, Gurney Foundry Co., Toronto.
F. C. Harding, Manager, Harding Motor Car Co., London, Ont.
F. A. Harrison, Boiler Maker, Polson Iron Works, Toronto.
H. Hughes, Machinist, Polson Iron Works, Toronto.
W. Harvey, Machinist, G.T.R., Toronto.
Fred. Harding, Financial Manager, Harding Motor Car Co., Newmarket.
J. Irwin, Engineer, G.T.R., London, Ont.
W. H. Jackson, Manager, Glidden Varnish Co., Toronto.
C. A. Jefferis, General Superintendent, Consumers' Gas Co., Toronto.
J. V. Jackson, Boiler Inspector, G.T.R., Montreal, Que.
C. A. Jackson, Machinist, Buffalo, N.Y.
I. Jefferis, Machinist, G.T.R., Toronto.
W. J. Jones, Machinist, G.T.R. Toronto.
A. Johnston, Travelling Engineer, McColl Brothers, Toronto.
J. G. Jones, Chief Engineer, Manufacturers Life Building, Toronto.
P. Jerreat, Machinist, Adams Harness Co., Toronto.
C. Johnston, Clerk, Consumers' Gas Co., Toronto.
J. Jackson, Boiler Maker, Consumers' Gas Co., Toronto.
A. Jones, Machinist, G.T.R., Stratford, Ont.
T. H. Jeffers, Foreman, Gurney Foundry Co., Toronto.

J. W. Jackson, Special Agent, Ontario Government State Department, Toronto.

W. L. Janet, Electrician, Toronto.

R. M. Jaffray, Mechanical Engineer, *Motor Times*, Windsor, Ont.

E. Kennedy, Engineer, G.T.R., Sarnia, Ont.

J. A. Kilpatrick, Manager, Canada Iron Corporation, Limited, Montreal, Que.

G. C. Keith, Editor, *Railway Journal*, Toronto.

G. Kyle, Steam Fitter, Consumers' Gas Co., Toronto.

A. H. Kirby, Chief Engineer, Methodist Book Room, Toronto.

W. J. Keating, Brass Manufacturer, Toronto.

J. Kennedy, Boiler Maker, G.T.R., Stratford, Ont.

J. C. Kyle, Representative, Philip Carey Manufacturing Co., Toronto.

L. H. Keller, Assistant Foreman, Structural Department, Canada Foundry Co., Toronto.

J. Kelley, Chief Engineer, Mercer Reformatory, Toronto.

J. Koiser, Foreman, Chapman Double Ball Bearing Co., Toronto.

A. J. Lewkowicz, Consulting Engineer, Universal Gas Co., Toronto.

F. W. Landymore, Telegraph Operator, G.T.R., Toronto.

C. A. Livingston, Durand, Mich.

A. Lichtenheim, Representative, Galena Signal Oil Co., Montreal, Que.

J. O. B. Latour, Insurance Inspector, Toronto.

P. J. Lynch, Superintendent, G.T.R., Allandale, Ont.

J. E. Lenehan, Representative, Galena Signal Oil Co., Richmond, Que.

W. Loveridge, Locomotive Foreman, G.T.R., Windsor, Ont.

E. Logan, Machinist, G.T.R., Toronto.

J. Lusk, Engineer, G.T.R., Sarnia, Ont.

J. Lyons, Engineer, G.T.R., Sarnia, Ont.

E. Linstead, Machinist, Consumers' Gas Co., Toronto.

W. G. Larmour, Draughtsman, Norfolk Marine Railway Co., Norfolk, Va.

F. D. Lyman, Manager, Supply Department, J. Millen & Sons, Limited, Montreal, Que.

J. L. Logan, Storekeeper, Canada Foundry Co., Toronto.

G. Little, Engineer, Consumers' Gas Co., Toronto.

R. E. Layfield, Assistant Superintendent, Canada Foundry Co., Limited, Toronto.

A. Laird, Machinist, Canada Foundry Co., Toronto.

J. P. Law, Engineer, Consumers' Gas Co., Toronto.

W. Large, Machinist, G.T.R., Turcot, Que.

J. R. Leckie, Locomotive Foreman, G.T.R., London, Ont.

D. Lamont, Assistant Storeman, G.T.R., Stratford, Ont.

C. Lennon, Representative, John Millen & Sons, Limited, Toronto.

C. R. Leake, Electrical Engineer, Factory Products Co., Toronto.

F. Lewington, Inspector, Canada Foundry Co., Toronto.

W. Loach, General Storeman, Canada Foundry Co., Toronto.

D. L. Lochrie, Brick Manufacturer, Toronto.

C. Laeon, Shipper, Canada Foundry Co., Toronto.

W. R. McRae, Master Mechanic, Toronto Railway Co., Toronto.

J. McWater, Machinist, Consumers' Gas Co., Toronto.

A. G. McLellan, Master Mechanic, C. & A. R.R., Bloomington, Ill.

G. McIntosh, Air Brake Instructor, G.T.R., Stratford, Ont.

N. McNicol, Storekeeper, Humber P.O.

W. McKay, Consulting Engineer, Robb, Armstrong Engineering Co., Toronto.

L. J. McLaughlin, Foreman, G.T.R., Madawaska.

P. H. McCabe, Engineer, Toronto Railway Co., Toronto.

T. H. McBrien, Engineer, Consumers' Gas Co., Toronto.

T. McLean, Machinist, G.T.R., Stratford, Ont.

H. W. McMillen, Bridge Inspector, C.P.R., Walkerville, Ont.

W. J. McCallum, Chief Draughtsman, Chapman Double Ball Bearing Co., Toronto.

F. McDonald, Foreman Boilermaker, C.P.R., West Toronto.

R. McIntosh, Engineer, G.T.R., Stratford, Ont.

W. M. McRobert, Chief Engineer, Power Plant, Canada Foundry Co., Toronto.

J. McGrath, Machinist, Massey Harris Co., Toronto.

T. McKenzie, Bursar, Mercer Reformatory, Toronto.

N. D. McIntyre, Superintendent of Construction, Canada Foundry Co., Toronto.

G. McLaughlin, Erector, Canada Foundry Co., Toronto.

J. W. McLintock, Clerk, G.T.R., Toronto.

W. O. Maclean, Foreman Patternmaker, Canada Foundry Co., Toronto.

P. E. McLelland, Fitter, Gurney Foundry Co., Toronto.

W. C. McGhie, Chairman, Ontario Engineers' License Board, Toronto.

C. McNair, Rule Instructor, G.T.R., Sarnia, Ont.

T. B. McCrosson, Machinist, Chapman Double Ball Bearing Co., Toronto.

P. A. McCrosson, Clerk, Chapman Double Ball Bearing Co., Toronto.

R. R. McCree, Ticket Clerk, G.T.R., Toronto.

G. McKenzie, Steam Fitter, F. Armstrong & Co., Toronto.

J. McGill, Electrician, Massey Harris Co., Toronto.

W. McDonald, Manufacturers' Agent, Toronto.

J. A. Mitchell, Foreman, C.P.R., Toronto.

C. Miller, President, Galena Signal Oil Co., Franklin, Pa.

J. H. Morrison, Representative, Federal Clay Products, Toronto.

G. T. Merwin, Representative, Pressed Steel Car Co., St. Louis, Mo.

J. Markey, Master Mechanic, G.T.R., Toronto.

P. J. Myler, Representative, Canadian Westinghouse Co., Hamilton, Ont.

J. Mooney, Road Foreman, G.T.P., Rivers, Man.

F. Moneypenny, Vice-President Imperial Varnish & Color Co., Toronto.

C. M. Murray, Sales Manager, Chapman Double Ball Bearing Co., Toronto.

F. G. Morris, Engineer, G.T.R., Sarnia Tunnel, Ont.

G. A. Mitchell, Master of Bridges and Buildings, G.T.R., Toronto.

R. Muirhead, Passenger Yard Master, G.T.R., Toronto.

J. Matheson, Charge Hand, G.T.R. Ferries, Windsor, Ont.

D. Murray, Manager, Murray Printing Co., Limited, Toronto.

J. Mauldey, General Foreman, Dominion Bridge Co., Toronto.

B. J. Markle, Superintendent, Dominion Bridge Co., Toronto.

W. R. Maynard, Storeman, G.T.R., Stratford, Ont.

G. F. Milne, Inspector of Machinery, Canadian Inspection Co., Toronto.

W. H. Moore, Secretary, Canadian Northern Railway, Toronto.

F. T. Malone, Representative Wm. Jessop & Sons, Limited, Toronto.

G. Morrison, Foreman, Pump Department, Canada Foundry Co., Toronto.

J. Mitchell, Engineer, Consumers' Gas Co., Toronto.

J. J. Maine, Vice-President, Polsons Iron Works Limited Toronto.

W. Marchington, Editorial Department, *Canadian Engineer*, Toronto.

J. J. Moat, Engineer, T. Eaton Co., Limited, Toronto.

W. Malott, International Weather Strip Co., Toronto.

W. A. Manion, General Manager, British-American Oil Co., Toronto.

F. F. Minard, Engineer, G.T.R., Port Huron, Mich.

F. Matthews, Carpenter, G.T.R., Toronto.

W. B. Moss, Purification Foreman, Consumers' Gas Co., Toronto.

H. Martin, Machinist, Consumers' Gas Co., Toronto.

T. H. Martin, Martin Pump & Machine Co., Limited, Toronto.

J. F. Morton, Erecting Engineer, Canada Foundry Co., Toronto.

J. C. Murison, Inspector, Canada Foundry Co., Toronto.

R. S. Magee, Machinist, Gurney Foundry Co., West Toronto.

R. Muirhead, Engineer, G.T.R., Stratford, Ont.

H. W. Mole Assistant General Storekeeper, Canada Foundry Co., Toronto.

T. F. Maher, Foreman, Boring Mill & Lathes, Canada Foundry Co., Toronto.

G. S. Morris, Mechanic, Consumers' Gas Co., Toronto.

J. E. Martin, Foreman Erector, Canada Foundry Co., Toronto.

A. Mitchell, Machinist, Gurney Foundry Co., Toronto.

J. Milne, Machinist, Consumers' Gas Co., Toronto.

W. Moss, Manufacturer, Moss Chemical Co., Toronto.

G. H. Mills, Florist, Toronto.

G. May, Signalman, G.T.R., Toronto.

F. H. Moody, Mechanical Editor, *Railway & Marine World*, Toronto.

R. H. Merriman, Secretary, B. Greening Wire Co., Hamilton, Ont.

H. A. Mosher, Manager, Sundries Department, H. W. Johns-Manville Co., Toronto.

C. Meldrum, Apprentice Instructor, G.T.R., Stratford.

E. A. Morrison, Superintendent, Molding Shop, Canada Foundry Co., Toronto.

J. W. Madigan, Electro Chemical Engineer, Toronto.

J. H. Marshall, Boilermaker, Polson Iron Works, Toronto.

R. Mullen, Steam Fitter, Evans Almirall Co., Toronto.

W. H. Nix, Head Road Master, Toronto Railway Co., Toronto.

W. A. Nixon, Night Foreman, C.P.R., West Toronto.

A. J. Nixon, Chief Operating Officer, Board of Railway Commissioners, Ottawa, Ont.

C. F. Neild, Coal Merchant, Stratford, Ont.

J. Nicholson, Foundry Foreman, Canada Foundry Co., Toronto.

A. E. Nourse, Assistant Engineer, Expanded Metal & Fireproofing Co., Toronto.

W. Newman, General Superintendent, Polsons Iron Works Limited, Toronto.

M. J. O'Leary, Special Representative, Canadian Oil Co., Toronto.

J. E. O'Reilly, Foreman, Ramapo Iron Works, Niagara Falls, Ont.

J. C. O'Brien, Secretary, Toronto Laundry Machine Co., Toronto.

W. Price, Locomotive Foreman, G.T.R., Lindsay, Ont.

R. Patterson, Master Mechanic, G.T.R., Stratford, Ont.

W. H. Plummer, General Yard Master, G.T.R., Stratford, Ont.

H. M. Patton, Engineer, G.T.R., Stratford, Ont.

R. Pearson, Machinist, Consumers' Gas Co., Toronto.

J. W. Perry, Machinist, G.T.R., Toronto.

F. W. Palos, Foreman, C.V.R., Montpelier Jt., Vt.

J. W. Pringle, Fitter, G.T.R., Sarnia Tunnel.

J. Powell, Chief Draughtsman, G.T.R., Montreal, Que.

F. A. Purdy, Manager, Canadian Gold Car Heating & Lighting Co., Montreal, Que.

C. S. Parker, Representative, Parker Car Heating Co., London, Ont.

J. Pratt, Storeman, G.T.R., Mimico.

W. C. Philpotts, Analytical Chemist, Consumers' Gas Co., Toronto.

A. G. Piper, Piper Railway Supply Co., Toronto.

H. W. Petrie, Petrie Machinery Co., Toronto.

E. V. Price, Chief Clerk, Construction Department, Canada Foundry Co., Toronto.

P. Philmore, Fitter, Canada Foundry Co., Toronto.

C. H. Patterson, Engineer, Dominion Government, Toronto.

J. Powell, Assistant Foreman, C.P.R., West Toronto.

A. Pype, Machinist, Chapman Double Ball Bearing Co., Toronto.

W. Patton, Engineer, G.T.R., Stratford, Ont.

B. W. Pharis, Superintendent, Grey Iron Foundry, Canada Foundry Co., Toronto.

H. Pedelty, Foreman Loom Molder, Canada Foundry Co., Toronto.

W. C. Pickering, Shipper, Dominion Radiator Co., Toronto.

R. Polson, Steam Fitter, Consumers' Gas Co., Toronto.

F. W. Prentice, Wireless Engineer, Canadian Train Control Limited, Toronto.

A. C. Pratt, M.E. Representative, Eadie Douglas Co., Toronto.

C. J. Poore, Representative, B. M. Jones & Co., New York, N.Y.

H. O. Phillips, Salesman, Canadian Steel Foundry, Limited, Toronto.

E. L. Purvis, Representative, Philip Carey Manufacturing Co., Toronto.

D. Peddie, Machinist, Gurney Foundry Co., West Toronto.

A. E. Quinn, Commercial Traveller, Toronto.

A. Russell, Machinist, Toronto.

M. J. Randall, Engineer, G.T.P.R., Rivers, Man.
J. A. Rowe, Machinery Supplies, Detroit, Mich.
H. E. Rowell, Manager, Philip Carey Manufacturing Co., Toronto.
W. D. Robb, Superintendent of Motive Power, G.T.R., Montreal, Que.
W. H. Randell, Water & Machine Department, Toronto Water Works, Toronto.
D. Ross, Engineer, G.T.R., Stratford, Ont.
D. Richardson, Foreman, Pump & Hydraulic Department, Canada Foundry Co., Toronto.
A. H. Reid, Manager, Reid & Brown, Toronto.
D. Ross, Machinist, G.T.R., Hamilton, Ont.
J. R. Ross, Engineer, G.T.R., Stratford, Ont.
A. L. Reading, Manager, Standard Inspection Bureau, Toronto.
H. W. Robinson, Tool Maker, Chapman Double Ball Bearing Co., Toronto.
E. L. Rilling, Manager, Hollands Manufacturing Co., Erie, Pa.
C. J. Read, Architect, Toronto.
E. Root, Salesman, Consumers' Gas Co., Toronto.
A. J. Roberts, Locomotive Foreman, T. & N. O. Ry., North Bay, Ont.
H. E. Richard, Representative John Millen & Sons, Limited, Toronto.
F. Ritz, Electrical Engineer, H. W. Johns-Manville Co., Toronto.
W. H. Robb, Representative, Anchor Packing Co., Montreal Que.
B. T. Riordan, Machinist, G.T.R., Toronto.
M. A. Ross, Treasurer and General Manager, Pyle National Headlight Co., Chicago, Ill.
H. Rogers, Chief Draughtsman, T. & N. O. Railway, North Bay, Ont.
J. Reid, Timekeeper, G.T.R., Toronto.
F. J. Ross, Manager, Dominion Supply Co., Limited, Toronto.
L. H. Rummage, Sales Agent, Buffalo, N.Y.
J. E. Rawstron, Storekeeper, Canada Foundry Co., Toronto.
A. W. Ritchie, Boiler Maker, Canada Foundry Co., Toronto.
D. Russell, City Representative, Canadian Fairbanks Co., Toronto.
A. W. Shallcross, Draughtsman, Tampa, Florida.
Hartley Spencer, Draughtsman, G.T.R., Stratford, Ont.
W. H. Smith, Chief Engineer, T. Eaton Co., Toronto.
G. E. Seegmiller, Engineer, G.T.R., Sarnia, Ont.
W. E. Saylor, Engineer, G.T.R., Sarnia, Ont.

G. Shand, Machinist, Consumers' Gas Co., Toronto.

W. Sharp, Engineer, G.T.R., Sarnia Tunnel, Ont.

W. J. Sutterby, Hostler, G.T.R., Hamilton, Ont.

J. H. Stortz, Locomotive Foreman, G.T.R., Mimico, Ont.

W. H. Smart, Toronto.

F. W. Sangster, General Manager, Metal Hardening Solution Co., Rochester, N.Y.

L. Salter, Machinist, G.T.R., Toronto.

F. S. Smith, Chief Clerk, Master Mechanic's Office, G.T.R., Stratford.

H. H. Scott, Engineer, Toronto.

W. C. Sealey, General Foreman, G.T.R., Toronto.

R. Stockhill, Machinist, Consumers' Gas Co., Toronto.

J. H. Shaver, Salesman, H. W. Johns-Manville Co., Toronto.

W. V. Shaw, Secretary-Treasurer, Robert Mitchell Co., Montreal, Que.

W. Smith, Boiler Maker, Consumers' Gas Co., Toronto.

J. Sharp, Draughtsman, Polson Iron Works Limited, Toronto.

F. Stortz, Machinist, G.T.P.R., Rivers, Man.

A. Stewart, Pattern Maker, Consumers' Gas Co., Toronto.

C. A. Saylor, Locomotive Foreman, G.T.R., Hamilton, Ont.

J. H. Shales, Engineer, Elevator Specialty Co., Toronto.

C. D. Scott, Representative, Gutta Percha & Rubber Co., Toronto.

L. W. Swift, Engineer, G.T.R., Stratford, Ont.

F. W. Slade, Machinist, Bawden Machine & Tool Co., Toronto.

C. Shook, Assistant Storeman, G.T.R., Toronto.

H. Sayer, Clerk, Canada Foundry Co., Toronto.

R. Stamp, Fitter, C.P.R., Toronto.

G. Service, Resident Engineer, National Iron Works, Limited, Toronto.

E. G. Southam, Gasoline Engine Manufacturer, Toronto.

O. Shier, Electrician, G.T.R., Toronto.

W. Schadel, Machinist, Newcombe Piano Co., Toronto.

F. Scott, Timekeeper, G.T.R., Toronto.

C. Schadel, Gentleman, Toronto.

J. Sim, Apprentice, G.T.R., Toronto.

W. R. Sexton, Manager, Sexton Boiler Setting Co., Toronto.

W. C. Skelding, Sales Manager, British-American Oil Co., Toronto.

H. Stuart, Inspector, Canada Foundry Co., Toronto.

P. D. Saylor, Sales Manager, Mechanical Department, Goodyear Tire & Rubber Goods Co., Toronto.

J. Shields, Machinist, Christie Brown Co., Toronto.

F. H. Squibb, Draftsman, Toronto.

E. V. Spidey, Mechanical Department, C.P.R., Winnipeg, Man.

W. J. Sanderson, Proprietor, Ontario Soap & Oil Co., Toronto.

F. Slight, Steam Fitter, Consumers' Gas Co., Toronto.

C. M. Smith, Engineer, High Level Pumping Station, Toronto.

E. Smythies, Secretary, Boiler Repair & Grate Bar Co., Toronto.

J. Scanlon, Travelling Engineer, G.T.R., London, Ont.

A. M. Smith, Master Mechanic, Toronto & York Radial Ry., Toronto.

H. Spratt, Travelling Engineer, G.T.R., Hamilton, Ont.

R. B. Shepperd, Engineer, City Hall, Toronto.

H. V. Sprecken, Assistant Foreman Molder, Canada Foundry Co., Toronto.

P. Smith, Boilermaker's Assistant, G.T.R., Stratford, Ont.

A. Taylor, Foreman, Boiler Shop, Polson Iron Works Limited, Toronto.

A. Taylor, Machinist, G.T.R., Toronto.

S. L. Trusler, Passenger Trainmaster, G.T.R., Hamilton, Ont.

W. E. Tait, Smoke Inspector, Toronto.

A. R. Thompson, Fuel & Tie Inspector, Belleville, Ont.

G. W. Thompson, Superintendent, Mechanical Department, T. Eaton Co., Toronto.

F. G. Tushingham, Engineer, Toronto Railway Co., Toronto.

S. Turner, Jr., Engineers & Machinists, Toronto.

R. Treleaven, Engineer, G.T.R. London, Ont.

G. S. Thompson, Draughtsman, Canada Foundry Co., Toronto.

A. E. Till, Foreman, C.P.R., West Toronto.

C. G. Till, Machinist, C.P.R., West Toronto.

A. Tory, Storekeeper, G.T.R., London, Ont.

C. A. Tobin, Draughtsman, Economical Gas Apparatus Construction Co., Toronto.

S. Tomlinson, Jr., Master Moulder, Toronto.

J. Tocher, Engineer, G.T.R., Stratford, Ont.

T. C. Tinline, Manufacturer, Wilkinson Plough Co., Toronto.

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A. Woodley, Foreman Moulder, Standard Foundry Co., Toronto.

E. Walker, Mechanic, Consumers' Gas Co., Toronto.

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J. H. Williams, Associate Editor, *Canadian Machinery*, Toronto.

E. W. Williams, Assistant Chief Clerk, Superintendent's Office, G.T.R., Toronto.

H. G. Woodley, Assistant Foreman, Standard Foundry Co., Toronto.

A. Woodley, Molder, Standard Foundry Co., Toronto.

W. W. Yeager, Machinist, G.T.P.R., Rivers, Man.

C. Young, Connecting Rod Department, G.T.R., Stratford, Ont.

E. G. Yeates, Manager, London Machine Tool Co., Hamilton, Ont.

G. A. Young, Machinist, G.T.R., Toronto.

G. Young, Electrician, Toronto.

R. Yemen, Assistant Storeman, G.T.R., Stratford, Ont.

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G. BALDWIN,
President

C. L. WORTH,
Sec-Treas.

THE CENTRAL RAILWAY AND ENGINEERING CLUB OF CANADA

OFFICIAL PROCEEDINGS FOR JANUARY, 1912

CONTAINS:—

REPORT OF JANUARY MEETING

AND

PAPER ON "MODERN STEAM POWER PLANT AND ITS APPLIANCES"

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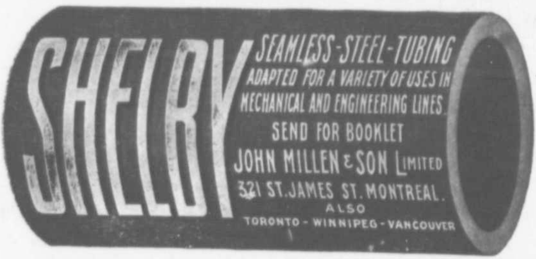

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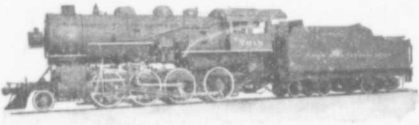

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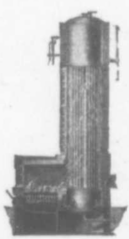

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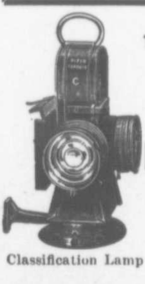

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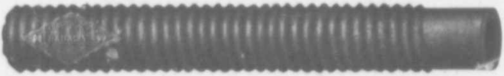

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MR. G. BALDWIN

General Yardmaster, Canada Foundry Co., Limited, Toronto
Retiring President of The Central Railway and Engineering Club of Canada

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OF CANADA

OFFICIAL PROCEEDINGS

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TORONTO, CAN., January 16th, 1912

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PROCEEDINGS OF THE CENTRAL RAILWAY AND ENGINEERING CLUB OF CANADA MEETING.

PRINCE GEORGE HOTEL, TORONTO, January 16th, 1912.

In the absence of the President, Mr. Bannon, Mr. Baldwin occupied the chair.

Chairman,—

Gentleman, will you kindly take your seats? The first order of business is the reading of the minutes of previous meeting.

Mr. Wickens,—

I move the minutes of the previous meeting be adopted as read.

Mr. Herriot,—

I will second that.

Chairman,—

It has been moved by Mr. Wickens, and seconded by Mr. Herriot that the minutes of the previous meeting be adopted as read. What is your pleasure? Carried.

Chairman,—

The next order of business is the remarks of the President.

The President does not happen to be here to-night. I understand Mr. Bannon is attending the Street Railway inquest. I am sorry that our esteemed 1st Vice-President is sick in bed, and our 2nd Vice-President is out of the city, consequently I am still in the chair.

I do not know that I have a great deal to say under this head. However, I would draw your attention to the fact that this is the beginning of the New Year, and that we would like to have the Members pay their dues. It is hardly necessary for me to tell you that the Club is in a flourishing condition, but we want the dues just the same.

The next paper to be read will be equally as interesting as the one we are going to listen to to-night. The title of the paper is "Soft Coal and a Smoky City," by our old veteran Mr. Wickens.

The Secretary has asked me to inquire if there is anyone present who would come forward and give a paper, for one of the months in the latter part of the year, September, October, or November, or if you know of anyone who would help us out?

The next order of business is the announcement of new members.

NEW MEMBERS.

W. R. Glasgow, Manager, Canadian Steel Foundries, Welland.

J. Trebilcock, Traveller, Toronto.

Fred. Harding, Financial Manager, Harding Motor Car Co., London.

J. Reekie, Engineer, Canada Foundry Co., Toronto.

L. Shipley, Rep. Shipley & Adams, Coal Merchants, Toronto.

G. H. Davis, Civil Engineer, C.P.R., Toronto.

A. W. Davis, Loco. Foreman, G.T.R., Statford.

H. Neild, Chargehand, G.T.R. Shops, Statford.

L. Dickinson, Machinist, Gurney Foundry Co., Toronto.

J. W. Walker, Moulder, Gurney Foundry Co., Toronto.

Chairman,—

I may say, Gentlemen, that these have been passed on by the Executive, and consequently are members of the Club. There are lots of men in this city who are eligible to join this Club. You will notice that we now read out the name of the proposer, as well as the name of the new member, which will give you some idea as to who is busy getting new members, and I think that if some of the other members looked around we might have a better list than this next meeting night.

MEMBERS PRESENT.

J. Kelley.	G. H. Davis.	A. M. Wickens.
A. Kastella	E. A. Morrison	A. G. Blaine.
J. A. Disney.	W. H. N. Davis.	A. E. Quinn.
E. B. Gilmore.	L. M. Watts.	W. M. McRobert.
J. A. Dickinson.	G. D. Bly.	J. Adam.
A. E. Hawker.	T. G. McKenzie.	J. Marshall.
B. Riordan	W. R. Gardner.	J. G. Abraham.
C. A. Jefferies.	J. P. Law.	F. Hardisty.
G. McKenzie.	H. Goodes.	A. Woodley.
W. C. Sealy.	W. S. Davis.	F. Dewar.
J. E. Rawstron.	H. G. Fletcher.	J. Herriot.
J. M. Clements.	E. A. Wilkinson.	H. H. Wilson.

R. S. Coxon.	R. B. Shepherd.	D. Cairns.
J. Wright.	E. Hebdon.	R. Pearson.
J. Douglas.	J. W. Walker.	G. Baldwin.
C. F. Nield.	J. Barker.	G. Black.
F. Wickson.	L. S. Hyde.	C. L. Worth.

Chairman,—

I will now read you a letter from Mr. R. Patterson, Master Mechanic of the Grand Trunk Shops at Stratford.

STRATFORD, January 11th, 1912.

MR. C. L. WORTH,

Secretary-Treasurer, The Central Railway & Engineering Club of Canada, Toronto, Ont.

Dear Sir,—I am in receipt of your letter of January 1st, 1912, advising that in the election of officers for the year 1912, I had the honor of being elected Honorary President of the Club.

I desire to thank the members for the honor which they have put upon me, and it was with much regret that I have not been able to attend as many meetings as I would have liked, but it has always been a great pleasure to me to do anything I could in the interest of the Club, and it will also be my aim to do so in the future.

Yours truly,
Robt. Patterson,
Master Mechanic.

The next order of business is the reading of papers or reports, and the discussion thereof.

We have with us to-night Mr. Kastella, who is going to read us a paper on which he has spent a great deal of thought and time, on "Modern Steam Power Plant and its Appliances." I have not the slightest doubt but what it will bring out a good discussion. While I would have liked to have seen a much larger gathering here to-night, I notice in the audience quite a number of members who are interested in this subject, and as Mr. Kastella is present I will ask him to come forward and read his paper.

Mr. Kastella,—

Mr. Chairman, and Gentlemen: It affords me a great deal of pleasure to come before your organization to-night.

As you all know, I am a German, and I have not been very long in this country. It has taken me quite a while to prepare this paper, and if it takes me as long to read it, I am afraid I would not be through in time to catch my train to-night. On account of my accent, which you may find it rather difficult to understand, if there is any gentleman here who would be kind enough to read this paper for me, I shall be glad if he will kindly come forward.

Chairman,—

I think if Mr. Kastella reads his paper as well as he has made these few remarks, we shall be very well satisfied.

Mr. Kastella,—

The paper is not as complete as I would like to have it as the subject is a very large one, but if you like the paper I shall be very pleased at some future time to come before you again and give you another paper along the same lines.

MODERN STEAM POWER PLANT AND ITS APPLIANCES.

By A. Kastella, Chief Engineer, Power Plant, G.T.R. Shops, Stratford.

My subject is of direct and personal interest to the owner and engineer of every power plant. The intention is, if possible, to awaken to a conscious realization, what is in a majority of cases an utterly careless and indifferent attitude to the engine and boiler rooms under their care.

To some it may seem that there is not much involved, and that other and more pressing questions come forward for adjustment first. I want to ask you, "Are your engine and boiler rooms all they might be," all they should be, and do each of you realize that they are at present what you have made them?

A great many mistakes are made in laying out and building a steam power plant, not only from inexperience, but also from trying to reduce the first cost of installation. As you are all aware any apparatus or safety appliance can be installed far cheaper before the plant is in operation, than afterwards; and those safety appliances should be considered not only in large plants, but also in any small ones.

The question arises, "Is it necessary when you are building a plant for yourself to have these safety appliances, or mechanical devices?" This question must be considered very carefully by the engineer in charge, also the owner of the plant. First of all, every plant cannot have the same mechanical devices, as nearly every plant is run under different conditions, and for different purposes. Another mistake is made when installing a plant, that you cannot do the work quickly enough for the company that is waiting to have the plant in operation, and sometimes you have not the material on hand that you should have, and many times you have to make a temporary job, to get the plant started as quickly as possible, but as very many steam plants are running under twenty-four hours' service; you cannot have the chance to change the work that was not done properly in the first place. Operating your plant under the above mentioned conditions may be a great loss and disadvantage to you, financially and practically. Then if you want to make any change, it means the shutting down of your plant for a certain amount of time, sometimes much longer than you expected. There you have another loss, which sometimes runs to a large amount.

In very many cases these mechanical devices or appliances in connection with a steam plant are condemned by the engineer in charge. It is quite true that some of these mechanical devices are not answering the purposes they should, but I am sorry to say that a great many power plant owners are not considering the position of the man in charge of their plant.

A great many mechanical devices and other machinery are condemned by inexperienced men, as they believe anything mechanical should work mechanically, without attention.

As I stated before some of these devices may not be suitable for your plant and conditions, but may be of first-class service for a different plant for which they are intended, and for this reason, before condemning any of your machinery or appliances, make a careful investigation to see if they were made for the purpose you want them. Are they large enough? Do you give them proper attention? Inquire into other plants of your type and size, and you will probably find out the trouble, and be able to correct these aforesaid troubles.

When visiting an engine room it will give you a fair indication of the engineer in charge, and with this most of you will agree. The engine room in which the distinct knocks tell of each revolution the engine or engines are making, the hiss of steam from leaky joints, the tools, oil, water and waste lying all over the floor, indicates in a fairly reliable way that the engineer is in action and appearance, without seeing him.

It is not necessary that tiled floors, white enameled brick walls, should be part of the equipment, but it is necessary that every engineer should see to it that the plant of which he has charge is kept in such manner that it does not reflect injuriously on him and his work in the eyes of his present or prospective employer; and these latter should see to it that an engineer and his engine room do not impress unfavorably an outside estimation of themselves. This may be prevented by their insisting on cleanliness and tidiness in everything pertaining to the power plant, and their encouragement and recognition of the engineer doing so. Boiler rooms generally suffer more than engine rooms, due largely to a poor layout in the matter of access and light for inspection, and being thus under a cloud as it were, does not draw attention or criticism to the same extent. Not enough interest is taken in them by engineers, in fact their absence from them is marked. This should not be allowed, because as a rule they have graduated from the coal shovel, and are naturally proud of the achievement of having left it behind, should not keep them from having care for the boiler room, as this is the most dangerous and most important part of the plant.

We will go a little farther into the economy question, which is very important. When a large manufacturing company is building a new factory, the first question, generally, is the power question. How they can buy or generate cheap power, so they may compete with other manufacturers. It would take too much time and space if I were to take this question up in detail from the smallest to the largest power plant. It is well known that the larger the power plant the cheaper the power may be generated. However, in some cases, from 15 to 40 per cent. increased efficiency could be derived from the majority of small plants by proper installation, care and attention.

We have a number of stokers on the market, but from your practical experience and from mine I think we find that the highest efficiency in regard to firing is obtained from atutomatic stokers.

At the Grand Trunk Shops power plant we are equipped with four chain grate stokers. Each has a grate area of 72 feet. I, personally, consider this stoker one of the greatest labour savers on the market to-day, under normal conditions. But suppose this automatic stoker, having a grate surface of 72 square feet, and the amount of coal that you can burn per square foot say, eighteen pounds, sometimes the demand for steam increases, and you have to increase the feed of your coal, say from eighteen to twenty-eight pounds per square foot, is it possible for you to get the same efficiency, not only from your coal, but also from your boilers, when you are over-rating your stokers and boilers. You have to travel the stoker at a greater speed, and the result will be that a large amount of combustible will run down to the ash pits, your combustion chambers will not be large enough to effect combustion of the extra amount of coal, and the flue gas increases, and the result is, that your efficiency is escaping through the chimney.

To be equipped with alarm water columns for low and high water is a great advantage, especially for small power plants, in which, I am sorry to say, you will not find the engineer or man in charge in his boiler room except when he comes around to put on a fire or to oil up his engine; then maybe he will have to go to repair a belt, etc., and sometimes does not go to the boiler room till the alarm whistle notifies him that the water may be too high or too low in his boiler. As I said before this device is a great advantage, but I may say it is, or rather may be, a great disadvantage also, for if this or any other kind of water column is not blown down at different times during the day, it may choke up with mud, with the result that the water level will remain the same, and the alarm whistle will not blow. In most of the new power plants, small or large as the boilers may be, the man in charge may depend on this alarm to warn him, but he may wait too long, and before he gets back his tubes or boiler may be damaged, or possibly blown up.

It is a very good policy for a steam plant to have a recording steam pressure gauge connected with the water column, as it will record every time that the man in charge blows down the water column, and these men will be more careful, as the recording pressure cards have to be sent daily to the office, to show if the man on his shift attended to his duties or not. The man who examines the recording pressure gauge cards should pay close attention to whether the water columns were blown down at least twice daily.

A very important thing in regard to boiler equipment is the pumps or other devices for feeding the boilers with water. In a great many power plants you cannot find more than one pump for this purpose, and this is a very great mistake. Every engineer knows that if his boiler feed pump fails the whole plant has to be shut down to prevent a boiler explosion or other damage due to running too long with low water in the boilers, trying to get the pump in operation without shutting down the plant. For this reason, not only every engineer, but also the plant owner should insist upon having a duplicate set of pumps, or other devices for feeding water to the steam boilers, not only to prevent shutting down, but also for the prevention of further serious damage.

FURNACE EFFICIENCY AND THE USUAL PRACTICE IN BOILER ROOM MANAGEMENT.

This subject is one, which may be expanded almost indefinitely, and which involves a consideration of all the requirements of modern stoking, and the inability of the individual to divide his attention, and obtain the same result as when his attention is concentrated. In other words it involves not only the preliminary of machine efficiency, but involves the question of human reliability and human weakness. I desire, therefore, to set forth the relation between furnace efficiency and the usual practice in boiler room management.

It is a well-known fact, and one from which the plant owner continually suffers, that it is extremely difficult to get the same efficiency from a number of units in service simultaneously, that may be developed when one unit is under test. The engineer in charge will usually proceed by taking some one unit and fitting it with the necessary pump and measuring apparatus for conducting a boiler trial or test. He will find, perhaps, that his furnace is not developing the efficiency to be expected. The results of his preliminary run will indicate perhaps too high a percentage of free oxygen in the gases, too large an amount of C.O. or too high a temperature of flue gases. The next step will be to remodel the furnace, change the type of grate surface, add to his height of chimney, increase his combustion arches, or in other ways seek to provide more satisfactory conditions for the development of these results which he knows he requires. Herein lies the first test of the engineer's ability, and no one can prescribe more than general rules for the perfecting of his boiler units.

A reiteration of the essentials for furnace efficiency need not now be set forth in detail, as they are common property, and have been rehearsed so often that they are practically universally known. The exact means, however, that must be used to secure the desired result, is an entirely different problem, although if the engineer has the ability to properly measure and co-ordinate the existing conditions, the remedies are usually comparatively obvious.

The problem of putting into practice the remedies, which he knows are necessary is another difficulty. The area designated as head room and floor space is to hold therein the products of combustion until such combustion is complete, and to support the burning fuel in such a manner that it may be burned with the minimum practicable amount of air.

Commerical considerations render it practicable to provide a furnace theoretically perfect, as the questions of cost and maintenance are quite as important in the final estimate as questions of daily efficiency, and we continually sacrifice efficiency in the furnace to the initial considerations of original cost, maintenance, depreciations, charges, ground rent, etc., etc. We have therefore to consider a certain efficiency as the maximum practical efficiency that may commercially be obtained, and this is expressed in terms of the furnace substantially as follows:

(1). It is not possible to burn bituminous coal with much less than 50 per cent. excess of air, or in the neighbourhood of eighteen pounds of air per pound of coal.

(2). It is not commercially possible to burn more than 98 per cent. of bituminous coal fed to the furnace.

(3). It is not commercially possible to extract so much heat from the escaping gases that their temperature shall be less than the temperature of the steam at the given boiler pressure.

These three primary considerations are the ones which should be first taken into account by the engineer in his analysis of furnace efficiency. The exact methods to be employed by him in determining the means for accomplishing the desired results cannot be herein prescribed, as they differ with every design of boiler furnace and grate surface.

That different boilers have different heat absorbing powers is unquestioned, and that different grate surfaces have different capabilities of retaining fuel under combustion is also unquestioned, and that there are different capacities for holding the gases of combustion is perhaps the most obvious of all. It should, however, be the aim of the engineer to secure not less than 10 per cent. of $C.O^2$ in the flue gases, which may be accomplished by stopping all air leaks around the setting of the grate surface, by keeping a uniform fuel bed without holes or leaks, by carrying a fuel bed of sufficient thickness that extreme porosity is avoided, and by not opening the furnace doors more than the necessary minimum. If all the air entering the furnace is compelled to pass through the bed of burning fuel in order to enter the furnace, satisfactory results must almost necessarily follow. It is the unauthorized air leakages that do the damage, and these must be eliminated. All the heat carried away in the escaping gases is lost, and it is obvious that this amount must be reduced to a minimum. Economizers will actually economize provided the resistance to the flow of the gases offered throughout does not cause greater loss by causing decreased efficiency in the furnace and increased waste in the ash pit. Not only must the temperature of the escaping gases be considered, but adequate furnace draught must be attained, or you will lose from one more than you will gain from the other.

As a general rule with bituminous coal satisfactory combustion cannot take place and proceed with .25 in. in the furnace. This is without reference to boiler capacity, which is a function of the grate area, as well as of the draught intensity.

Flue gases in temperature cannot be reduced below 425 degrees F. and a working temperature of 500 degrees F. to 550 degrees is usually considered as satisfactory as it is practical to obtain. Any increase of this temperature may mean either a short circuiting of the gases of the boiler, due to defective baffles, excessive velocity of gases in the boiler setting, or air leakage at or near the furnace. It may be due also to defective heat absorbing power of the boiler, the result of scale or soot inside or outside of the tubes. It is safe to say, therefore, that any temperature over 550 degrees in the flue should at once cause an investigation, that the absorption may be increased and the waste at this point decreased.

With the unit in a satisfactory condition of efficiency, the next problem is to extend this efficiency throughout the boiler room, and operate a number of units in such a manner that the over all results may be as nearly as possible equal to the unit result. This is a question which involves the ability of the operator to divide his attention, and is very largely a question of discipline in the boiler room.

It frequently happens that there is 10 per cent. or 15 per cent. less efficiency when the entire plant is considered, than is shown in a single boiler test, so it becomes very important that the management should establish such routine and system as will offset the negligence, carelessness or inability of the fireman.

Perhaps the most satisfactory method is the method of continuous test, which is one of original equipment and systematic operation. In this system each furnace is supplied with coal, which passes through a weighing tank, so that the exact amount of coal burned in every furnace is made a matter of daily record. The entire plant is equipped with recording Venturi meters, and if possible each unit is supplied with an indicating Venturi meter in the auxiliary feed line. Daily records of the recording meter are kept up and by means of the individual indicating meters the water consumption of a particular unit may be checked up at any time.

Attached to each boiler is a Hay's gas sampling tank, which may be adjusted to withdraw a sample of the flue gases for any period desired. The station is equipped with the gas analysis instrument, by which the engineer may analyze his various gas samples daily, or on each shift. This result should be posted in the boiler room, with the name of the fireman indicated thereon, and any fireman not developing the required quality of gas is in line for some private instruction. A daily sample of the ash from each boiler is taken and analyzed for combustible. This result is also posted in the boiler room the following day with the number of the boiler and the fireman in charge thereof.

It will be found that competition between various firemen or various shifts will be immediately established, and the tone of the entire boiler room will be improved almost automatically. If it does not have this result the chief engineer has the information at hand that will enable him to apply the pressure in the right place.

All of this might seem like an unnecessary expense, and an impracticable proposition, but in the plant containing many boilers it is economy of a proper and essential kind. When the waste of heat up the stack and into the pit is measured in dollars and cents, there will be no question as to the saving to be effected by the above procedure, and all that is necessary to convince the skeptic, is to figure what it would cost to do this, and what it would cost not to do it.

The above system supplies the essentials for a continuous test, and the engineer in charge can daily check up his operatives, placing the blame for low efficiency exactly where it belongs, and thereby be equipped with the information necessary for the immediate elimination of the waste.

As in other matters, eternal vigilance is the price of economy, to paraphrase a well-known author. "The descent into inefficiency is easy."

AUTOMATIC STEAM REGULATIONS.

The economy of automatic steam regulation in a boiler plant is of sufficient importance to warrant any manager or superintendent taking the time necessary to investigate it.

The prime object of damper regulation is of course when the steam rises above the required pressure, and a great loss is being sustained by the engine being supplied with steam at lower pressure than it requires to do its work properly and easily, to so handle the feeding of the fuel, and to so regulate the draughts, that steam may be supplied to the engine as it may need it, and at constant and unvarying pressure.

It is practically impossible for the fireman to maintain steam at an exact pressure without mechanical aids. The varying load of an engine, caused by the throwing on or off of the various machines throughout the plant, or the different amount of work which these machines are required to do, affect the amount of steam which is used by the engine. If all the machines are working to the limit of their capacity, the engine is taking a great deal more steam to keep them going at the proper speed, than if some of them are idle or working light. The fireman has no means of knowing when the load is going to be light or heavy, the best he can do is to keep the steam at about the required pressure.

If the load, or in other words the amount of work, which the engine is doing, should increase for a while, or be kept at full capacity, the fireman would keep a hot fire under the boiler in order to generate steam enough to keep the engine turning at its correct speed. Should the work on the machines slacken, which it will do for any one of a number of reasons, such as the stopping of a certain set of machines, this action would lighten the load on the engine, causing it to take less steam through the action of the governor, but the fire under the boiler would keep on generating steam, which at this time the engine has no use for. The result would be that the steam would rise, and the safety valves release the pressure, thus allowing the excess steam to escape into the open air. This, of course, is a waste of steam, water, coal and labor, which means a loss of money to the owner. This may be prevented by a damper regulator, just as an engine is prevented by the governor from running away.

The damper regulator acts on the boiler just as the governor acts on the engine. No one would think of asking the engineer to stand by the controlling valve of his engine in order to regulate the amount of steam it should have to keep it turning at a speed to so regulate the revolutions of the line shaft as to produce the necessary amount of work throughout the factory.

We all know that the machines throughout a plant do their best work while running at a certain speed. Their speed is regulated by the size of the pulleys attached to the line shaft. The speed of the line shaft is regulated by the engine. The number of revolutions made by an engine in a given length of time is controlled by the steam supplied to it by the boilers, and regulated to a certain extent by its governor.

When the steam drops below the required pressure only a few pounds, the governor will keep the engine turning at the same speed, but it will be by the admission of more steam to the cylinder. To maintain the engine speed the steam consumed is increased in two ways, first, by its expansive power as the pressure is reduced. The higher the pressure the drier the steam will be, causing quicker action and more expansive force, thereby doing more work with a less volume of steam. When the steam is low the engine takes more of it to do the same work. This means that more water has to be evaporated, that more water has to be pumped or injected into the boiler, which also requires more steam, all of which means that more fuel has to be burned in order to evaporate the extra water required to make the extra steam.

If when the steam is low the full load is put on the engine by the operation of all the machines in a plant, or an extra load on some of them, the machinery throughout the entire plant will drag, and the production of that day will be less than normal. This condition may be prevented by automatic damper regulator. When the steam reaches the given pressure it closes the upper, or back damper, on the instant, it does not wait until the steam has gone over the mark, nor does it close it before the steam reaches the required pressure. By closing the back damper the heat arising from the grate is held in the tubes and around the boiler, so that the damper may be shut longer, and the steam pressure remain up longer, without burning more fuel than would be burned when the fireman closes the ash pit doors, allowing the heat to be free to pass on to the stack. The latter method is resorted to when no regulator is used. When the upper or stack damper is closed, the air is entirely prevented from passing through the coal. Coal will not burn unless supplied with air. This leaves the coal lying on the grates, but not burning, ready the instant the damper opens to start generating more steam, thus keeping a more even heat on the boiler and tubes, and preventing the contraction and expansion, which causes so many leaky tubes. When the damper is used the ash pit doors remain open, allowing the air to circulate under the grate bars, which keeps the latter in better shape and makes them last longer than they would if the ash pits doors were closed, thus shutting out the air and allowing the intense heat of the furnace to strike down.

Where there are automatic stokers under the boilers, the damper regulator is connected with the stoker engines as well as with the damper. When the damper closes, the stokers are slowed down so that the supply of fuel is checked until the damper opens again, and more fuel is needed. This is accomplished either by a mechanical connection to a quick opening valve or by a water connection between the regulator cylinder and a pressure regulator on the stoker engine supply line. When burning gas or oil as fuel, an extra quick opening valve is used on the burner supply pipe, and the regulator opens and closes this valve as well as the damper. This cuts off the supply of gas or oil and insures a positive saving.

ENGINE EFFICIENCY.

The efficiency of the steam engine is often based on the amount of fuel burned per indicated horse power per hour, but is more properly based on steam consumption.

The highest class of steam engines running condensing will use under test conditions from twelve to twelve and one half pounds of water in the form of steam per indicated horse power per hour, while the ordinary automatic cut-off engine, with single expansion, non-condensing, uses from twenty-eight to thirty-five pounds. The fuel used per horse power per hour, therefore, depends on the quality of coal and the efficiency of the boiler and furnace, as well as upon the efficiency of the engine.

A good boiler, properly set and fired, will show a much higher efficiency in per cent. than the engine. When operated with high grade coal and under the best of conditions, a boiler may deliver to the engine as much as 75 per cent. of the theoretical heat of the coal, and if the coal contain 14,500 b.t.u. per pound, this is equivalent to 9.78 pounds of water evaporated from a feed water temperature of 120 degrees to steam at 200 pounds gauge pressure. If the engine uses 12 pounds of steam per horse power, this means a coal consumption of 1.23 pounds per indicated horse power per hour, or if the engine uses 30 pounds of steam, a coal consumption of 3.07 pounds. These figures, if transposed, for efficiency would be about as follows: one pound of coal having 14,500 b.t.u. is equivalent to 11,281,000 foot pounds, which on a supposition of 75 per cent. efficiency in the boiler, is equal to 8,460,750 foot pounds, of which if all is utilized by the engine, would produce 4.29 horse power for one hour, or at the rate of .233 pounds of coal per horse power per hour, instead of the amounts above stated.

On this basis the highest class engine has an efficiency of scarcely 19 per cent., and the other of a little more than 7½ per cent., and the efficiency and boiler combined, is but 14¼ per cent., and 5.7 per cent., respectively. It is economy, therefore, in most cases to use a high class engine. There are instances, however, where the engine is used for so short a time in each year, that the saving may not be sufficient to pay the interest on the additional cost, and a cheaper engine, even if comparatively wasteful, may be better economy.

Compound engines, when high pressure can be obtained, have an advantage in economy over single cylinders, and triple and quadruple expansion engines under some conditions, show a saving over simple compound, but they require a pressure of 150 to 200 pounds, and a comparatively steady load to develop their advantage to a great degree.

A large boiler is generally an advantage, but it is not economy to use a large engine to develop small power. To make sufficient steam to fill the cylinder at the terminal pressure, each stroke has to be furnished, whether the engine is doing more or less work, and this frequently amounts to far more than the steam used to do the work. Thus a 24 in. by 48 in. engine, making 60 revolutions per minute with cut-off uses 30 horse power of steam in displacing the atmosphere without exerting any available power. For the same reason back pressure greatly increases the cost of power.

When selecting an engine for any particular power plant, the first thing to decide is the amount of power required. If an engine is already installed, and the new engine is only a replacement, this is an easy matter, as indicator cards may be taken from the engine which is to be replaced. If the power house is an entirely new one, then a list of the machinery to be driven will have to be made out, and the total power determinded from the amount taken to drive each one individually.

Great care should be taken when figuring out the power to take into account the length of time, and also the particular time of day, during which each machine will run, as this has a great bearing on the determination of the proper size of the engine. When the list of powers and time of running of each machine is fixed, a power curve should be laid out, showing the variation in load on power house during the twenty-four hours or portion of it, which constitutes the daily run. This power curve will give the minimum average and maximum, or peak loads, and an examination will tell whether it is best to develop the power with one unit, or divide it between two or more units.

When the power to be developed has been decided, it is then necessary to examine the running conditions of the plant. The first thing to find out is the steam pressure available, and whether the steam is superheated, and if so, the degree of superheat, also whether the engine is to run condensing or non-condensing, and if the latter, the amount of back pressure.

If there is an exhaust steam heating system in connection with the plant, the amount of exhaust steam needed, and the number of months in the year it is in operation, will have to be determined. When this information has been collected, it will be seen how much steam economy will effect the selection, for if the heating system takes as much or more steam than the engine does to develop the power required, the steam economy is not of such importance as it otherwise might be, but in the majority of plants in this country of any size, the element of steam economy enters largely into the problem by reason of the fact that the steam required for power is largely in excess of that required for heating, and that the heating plant is shut down for about half the year. This being the case it is necessary for the engineer to determine the most economical engine for his purpose. His choice will be somewhat influenced by price, but in the long run it pays best to buy a well-made engine, built by a reputable firm, and one that is economical in the use of steam.

Any good firm of engine builders will give a guaranteed steam performance of their engine, but this guarantee should be carefully examined to see that the guaranteed performance is under the same conditions that the engine is to run, particularly should this be done where the engine is to run on saturated steam, as many engines which are built especially to run with superheated steam and give good results under these conditions, fall down badly when running on ordinary saturated steam, and it is the builders of these engines that are apt to give their guaranteed performances with superheated steam, resulting in disappointed customers, who have overlooked the difference in conditions.

For all round economy and reliability the four valve or Corliss type, as now built by the best makers, will always hold first place, but the purchase of a cheap type of this engine should be avoided, as it is only by careful work in connection with the wearing parts, and such machine work as will ensure tight pistons and valves, that the low steam consumption guaranteed by the best makers is obtained.

The cost of keeping up repairs on this type of engine has often been used as an argument against it, but an examination of the records of the best builders will show an astonishing number of engines that have been running for years without a cent's worth of repairs.

At the Stratford Grand Trunk Shops we have two Corliss Cross Compound Non-condensing engines running under 150 pounds steam pressure, and 150 r.p.m. These engines have been in operation for three years, running on an average eighteen hours a day, and I personally consider these engines as good to-day as when we received them, and up to this date we have not spent a single cent on these engines for repairs.

The problem of increasing the capacity of an existing power house, which is already crowded for room, has been successfully solved by the advent of the exhaust steam or low pressure turbine. The chief reason for the rapid growth in favour of the low pressure turbine, is the fact that the steam turbine is much more economical in the low pressure stages than a reciprocating engine, it being capable of producing a horse power on or about 30 pounds of steam at atmosphere pressure and 28 inches of vacuum.

It will thus be seen that if we have an engine that develops a horse power on 15 pounds of steam when running condensing, and 20 pounds when running non-condensing, and put the steam into a low pressure turbine, we would have, (allowing 5 pounds per horse power hour for condensation in the cylinders) 15 pounds left to put into the turbine, and there develop $\frac{1}{2}$ horse power, or altogether $1\frac{1}{2}$ horse power, with our original 20 pounds of steam, or at the rate of $\frac{2}{1}\cdot\frac{0}{5}=12.5$ pounds per horse power for the combined engine and turbine.

This will give a rough idea of where the gain comes in by using an exhaust steam turbine, which not only increases the capacity of the plant 50 per cent., but decreases the steam consumption per horse power $16\frac{1}{2}$ per cent.

The low pressure turbine with its condenser and other auxiliaries would not take up more than about one-half the floor space of the original unit.

To every engineer who is operating a steam plant, I would like to say, give your engine and boiler room your best and most careful attention, and show administrative ability, and then you will get the best efficiency that may be gotten out of a steam plant such as yours may be.

Chairman,—

Is there anyone who would like to ask any questions of Mr. Kastella?

I am sure we have all listened with a great deal of pleasure to this paper to-night, and as Mr. Kastella has only been in this country a couple of years, I think he has done remarkably well in the matter of picking up our language, and as the paper was such an excellent one, I am sure it will bring out a good discussion.

I have asked if anyone wishes to ask any questions but as no one has responded, I will ask Mr. Wickens to open the discussion.

Mr. Wickens,—

Mr. Kastella has certainly done remarkably well, especially when one considers the short time he has been in this country. I am quite sure that there are not many men who could leave Canada, and go to Germany, and get up a paper in German as fluently as this has been got up in English in the short space of two years. I think Mr. Kastella has covered nearly every point in connection with this question. He starts out by telling us that a good plant should be carefully studied in all its details at the time it is being constructed and installed; that is perfectly right. The trouble with ninety per cent. of the steam plants in Ontario to-day is the lack of this attention during construction. In the early days when a man was going to put up a steam plant, he did not consider efficiency, he simply sat down and figured out how he could put up a plant for the least amount of money irrespective of efficiency. We have a large number of plants all over the Province of Ontario, that are a long way from being efficient because they are not built properly, the boilers are not properly set, and they are not getting efficient operation for each pound of coal consumed. The engines are not designed for the work they are called upon to handle, and the cost of operating these plants is much too large in proportion to the amount of work they have to do. It is in consequence of this that we hear so much about the cheapness of operating plants by electricity developed at Niagara Falls. The electrical engineer will come along and tell them that he will deliver power to them for so much. It is more than likely that he will give them a price on the peak load, perhaps the peak load will hardly ever be reached and the man who is induced to take the electric power is likely to have to pay more than he did with his steam plant. He does not realize that he has got to remodel his plant, and put in motors, that he has got to spend as much money for his motors as he spent for his steam plant, and he does not realize that by spending this same amount of money on his steam plant that he could put it in first-class condition from which he would probably obtain far better results than he can obtain by use of electrical power. He would have to have a plant to heat his buildings seven months in the year, and he would have to still go on buying coal if he put in an electric plant, whereas, with his steam plant he is able to heat his buildings and develop his power at the same time.

Then Mr. Kastella leads us on to mechanical appliances for reducing or cheapening the operation of the plant. These appliances are allright if you have a competent engineer to look after them. Whenever I hear of these mechanical appliances I always think of the Irishman who went into a hardware store to buy a stove. They showed him a nice little stove and told him the price was $25.00 and that it would save 25% of his fuel over the ordinary kind, he looked at it for a while and then asked to be shown another. The price of the next stove wa $30.00 and it would save 30% of the fuel, and after talking to him for a while they led him on to their own particular pet stove which would cost him $45.00 but would save him 50% of his coal. After a little contemplation the Irishman said "I'll take two of them and I won't have to buy any coal at all."

There is one trouble with these mechanical appliances, and that is, that they are machines, and require attention. The average engineer gets one, and for the first six or eight months he is playing with it all the time, after a while it gives him a little trouble and then he does not think so much of it, and by and bye he thinks it is a nuisance. There is no question that a number of these appliances are very useful, but, to keep them useful they must be kept up to a high state of efficiency all the time. It is only a short time ago we got an apparatus by which the analysis of the gases from the furnaces could be analyzed, but there are very few engineers who have followed this up, consequently, especially in small plants, the advantage to be gained from such an apparatus is practically of no use. However, there is no doubt of the usefulness of this apparatus in a plant where there are three or four men firing. It is possible by means of this apparatus to get a little rivalry between them, for efficiency, and when the results are posted in the boiler-room, it naturally makes them more careful.

Mr. Kastella has done remarkably well in covering the general ideas for gaining efficiency in a plant.

He also speaks of the use of exhaust steam.

I have in mind a case where a reasonably large electric plant having reached the limit of their present engine and boiler capacity, and finding their requirements growing larger, and their plant limited to the piece of ground on which it stood, they looked about for some means of increasing the capacity of their plant without having to increase their floor space. They consulted with some engineers and finally decided to install the low pressure turbines behind their present reciprocating engines. The engine-room was situated over a basement which they were able to utilize for the installation of these low-pressure turbines. The result is that after putting in these turbines they were able to develop 750 h.p. more than their plant was capable of developing previous to the installation of the turbines from the exhaust steam of their original plant. The turbine is connected to the generator, which is connected to the buss bars on the switch board and requires no governor, it simply rotates and takes its steam from the engines, and they are able to develop this extra power with the same men and the same boilers, and everything else as it was before, except for a little more oil to lubricate the journals of the rotors.

That is a place where the low pressure steam turbine is doing good work. Mr. Kastella happened to have referred to this particular class of machinery, and as the plant I am speaking of has only just installed them I thought it might be an interesting illustration.

I think Mr. Kastella has reached the most vital points in the equiping of modern plants and gone very thoroughly into the subject. I am sure he will be quite willing to answer any questions that may be asked of him.

Mr. McRobert,—

Following up Mr. Wickens' remarks in reference to using the exhaust steam from the engines to run the low pressure turbines. I should like to ask Mr. Wickens how they managed about the heating of the plant when they used the exhaust steam to run the turbines?

Mr. Wickens,—

This happens to be an electrical plant, and there is no heating in connection with same.

Mr. Kastella,—

In reference to the mechanical appliances, I must say that at first I was very much against them, but on visiting some of the larger plants, I began to see their advantages.

When I am called upon to take charge of a plant, the first thing I would like to know is where I can make a reduction in the cost of running the plant. When I started at our plant we had vertical boilers standing up about 30 ft. and a large platform from which the men had to watch the water glasses and gauges. This necessitated having a man on duty night and day for this purpose. I suggested that we put on a boiler feed water-regulator, then the question came which was the best to use. I could not say which was the best, and I decided that the best way to get the information was to go around to one or two plants and see for myself. The result was that I went to some large power plants and decided which was the most suitable. Any time you come to our shops I can show you our water regulators which have been in use for three years, and on which not a cent has been spent since they were installed and during that time they have saved us $125.00 per month.

In regard to abandonding the steam power plants, and installing an electrical plant to use Hydro-Electric Power, I, of course, am not in favor of it. I think if the owners would take a little trouble and investigate before deciding on the electrical power, they would be better satisfied in the end. I know there are several former steam users who, since installing the Hydro-Electric Power, are beginning to open their eyes. I am quite sure that with a properly equiped steam power plant there is no question but that we can compete against the Hydro-Electric system.

When I came to the city to-night, I read in the papers about a rotary engine and as I am interested in anything of this kind I went along King St. and looked through the window where they are on exhibition and saw a nice little engine running very smoothly. I went inside to get some more information, and after talking awhile I told them I thought it was a pity that they had not got their engine out before the introduction of the Niagara Power.

If anybody has any more questions to ask, I shall be only too pleased to answer them.

Mr. Bly,—

I would like to ask Mr. Kastella how many pounds of water he can evaporate per pound of coal with chain grates, and if chain grates are useful in preventing smoke?

Mr. Kastella,—

I have operated practically every kind of mechanical stoker on the market, and I do not think that you can get anything better or anything that will save labor and at the same time be as economical as the chain grates. As far as my experience goes there is nothing on the market to-day to equal the chain grate. At Stratford we use chain grates, if for any reason it is necessary to increase your steam power all you have to do is to make your grates travel faster, and if you are not using so much steam the grates can be slowed down, and by this means economy with the steam is effected, of course, if you send the grates along too fast the coal is going to travel over the arch and thus be wasted, but this is merely a matter of regulation.

With these stokers you have no smoke whatever as long as you run them at a normal speed; at times I have used the worst coal you can get. I have also used lump coal which has been crushed, but I found that with the crushed coal we could not crush it fine enough to burn satisfactorily as the small lumps run over the arch before they were properly consumed.

I find that we obtain the best results from the very fine coal, as with this coal when the occasion arises you can run your grates faster without any waste.

Mr. Bly,—

In regard to automatic devices. No doubt some of them are good under certain conditions. I once had charge of a plant on which we had an automatic apparatus for shutting off the water when the glass broke. The plant ran for about two years and was always giving trouble with the water coming over into the engines making it necessary at times to shut down the engines. I found on investigation that the automatic shut-offs were being opened to far and closed on the opening side. I took off the valve and put on an ordinary hand valve and we had no trouble after that with the water overflowing.

Mr. McRobert,—

Is there any type of engine which will develop a h.p. for 1.23 pounds of coal per hour?

Mr. Kastella ,—

Under normal conditions there is no engine built in the world to-day that will do this. I may say, however, that there are engines in Canada that if they are properly attended to they will run below 3 pounds under normal conditions.

Mr. Bly,—

In my first question I asked Mr. Kastella how many pounds of water he can evaporate per pound of coal with chain grates. No doubt Mr. Kastella overlooked this question when he made his reply. I have in my plant an automatic furnace, and recently I ran some tests and got some pretty good results. It was somewhere about 10.2 to 10.9 pounds of water per pound of coal, of course these tests were run under practically theoretical conditions. I found the greatest efficiency at about 125 pounds saturated steam, and we got 185 h.p. Then we ran a test for capacity and got 285 h.p. per hour. We used soft coal screenings. We had a hand fired test with hard and soft coal screenings and got 312 h.p. per hour.

Mr. Kastella,—

At Stratford we run a test every year. The last test we ran was from six weeks to two months, and we obtained the following results.

Water evaporated actual per lbs. of natural coal, lbs.	8.38
Water evaporated actual per lbs. of dry coal, lbs.	8.72
Water evaporated from and at 212 deg. natural coal, lbs.	9.90
Water evaporated from and at 212 deg. dry coal, lbs.	10.06
Water evaporated from and at 212 deg. combustible	12.10

Cost of coal to evaporate 1000 lbs. of water from and at 212 deg. 8.34c.

Mr. McRobert,—

As I am somewhat interested in super-heated steam, can you tell me what experience you have had along this line; and what is your experience of the saving effected by using super-heated steam in comparison with saturated steam? Is there any thermo-dynamic value attached to the use of super-heated steam, or is the only saving effected by the overcoming of condensation in the cylinders.

Mr. Kastella,—

As far as my experience goes I am sorry to say that I do not know very much about the use of super-heated in either turbines or steam engines. As far as my knowledge goes I find that super-heated steam is more efficient than saturated.

Mr. McRobert,—

Where is this efficiency?

Mr. Kastella,—

It seems to be less condensation.

Mr. McRobert,—

Is there any other advantage?

Mr. Kastella,—

I do not know of any other advantages, there may be some other advantages, but as I said before, the only real advantage I can see is the small amount of condensation.

Mr. McRobert,—

In regard to lubrication required when using super-heated steam. Do you not find that it requires more lubrication?

Mr. Kastella,—

The lubrication is higher naturally on account of the greater heat. As far as my knowledge goes it seems to be hard to get the right kind of oil to properly lubricate the cylinders, and from enquiries I have made it seems much easier to keep your cylinders properly lubricated, with saturated, than with super-heated steam.

Mr. McRobert,—

Would you think that the increased consumption of oil would be half as much again?

Mr. Kastella,—

Not that much. A short time ago a test was made in the works with very high dry steam, which resulted in an increased consumption of oil of about 1-3 to get the same lubrication.

Mr. Wickens,—

It appears to me that in the question of super-heated steam the thing to know is how much super-heat you are going to have. Suppose you are using steam 100 lb. pressure at 306 degs. well you can get plenty of cylinder oil that will stand 600 degs.

I think the most useful point in connection with super-heated steam is that you can run a reciprocating engine almost without any piston clearance. When you have saturated steam you have got to have a good clearance. With super-heated steam you get the expansion before the steam begins to condense and the result is that a clearance of 1-32 or 1-16 in. is all the clearance at each end of the cylinder that is necessary. This I think is one of the striking points in using super-heated steam.

Mr. McRobert,—

In reference to the chain grates. How do you find coal that contains sulphur? Some class of coal runs very high in sulphur, and consequently clinkers badly, the clinkers being very hard to remove.

Mr. Kastella,—

That is a trouble I have been up against. We had some coal at Stratford which was very high in sulphur, and I found at the end of the week that I had to cut out one of the furnaces in order to get the clinkers off the grate. I found that by wetting the coal we got rid of a good deal of this trouble, As long as the grates were running at a normal speed, I found by using the poker we were able to control the clinkers to a certain extent, but as soon as we began to over-load and run the grates faster, I found that the sulphur ran all over the grates and carried the fire along with it, consequently I had fire on the bottom of the grates as well.

Mr. McRobert,—

Which do you find the most successful, the return tubular boilers, or the water tube boilers?

Mr. Kastella,—

My experience has been that you can get equally good service from either type of boiler.

Mr. Wickens,—

Is there any trouble in keeping up the arches in the chain grate furnaces?

Mr. Kastella,—

There are two arches in the chain grate furnace. I may say that the combustion arch was in operation for three years before being renewed, but the igniting arch we have to renew once every 18 months.

Mr. Bly,—

Mention was made of a certain automatic stoker. The representatives of these people came to my place, when I was putting forced draft under my boilers, and they said that I would soon burn the bottom off my boilers. I told them that it was necessary to use a forced draft to keep up with my requirements. I may say that I have been using the forced draft for five years, and up to the present have not burned the bottom out of my boilers.

Mr. Kastella,—

Before coming to Stratford, I was called into a plant in which an under-feed stoker was in operation, and which for some reason or another had not been giving satisfaction. I was in the plant three weeks before I discovered what the trouble was, and I consider that, considering what the trouble was, I found it very quickly. I went over the plant very carefully and in the end I found that the valve controlling the air supply had become disconnected, and after this had been fixed the furnace was started up again and is running satisfactorily to-day. The fault was blamed on the stoker, but you can see from this that the stoker was not responsible for the trouble.

Mr. Jefferis,—

I have been listening to the discussion of this paper, and I think it is a very good one.

The discussion brings this thought to my mind, is not about 75% of the troubles in connection with steam plants caused at the commencement by not having the plants properly installed? Would it not be better for the average owner when the necessity arises for extensions or improvements in his plant to hire the services of a consulting engineer? There is a great difference between designing plants and operating them. The average operating engineer commences as a fireman, or perhaps, as a machinist or something of that kind. His time is devoted to running the engine or repairing it, and when he is called upon by his employer in connection with the extension or improvement of the plant he wants to hold his position you know, so he advises his employer to the best of his ability. Naturally he makes mistakes, his advice is often wrong and his employer possibly in consequence of this dismisses him. Now, if a consulting engineer was employed it would be far better for the operating engineer. If the installation was not put in properly he would not be to blame and if the people who were manufacturing the appliances were placed under heavier penalties so that thay had to fulfil their guarantee, it would be much better for the owner, and incidentally the operating engineer. Many a good faithful man has lost his position simply because he could not explain something which really should be explained by the man who designed the plant, and I think that if the engineers who are operating these plants would suggest to their employers, when the matter of installing large units of power or increasing the plant is brought up, the advisability of engaging a specialist along that line, it would be better for all concerned. A consulting engineer would be responsible for seeing that the manufacturer fulfils his guarantee.

I believe Mr. Wickens and Mr. Kastella will bear me out when I say that 40 or 50% of the plants in operation to-day are unsatisfactory for the reasons I have mentioned.

Mr. Wickens,—

Quite true.

Mr. Jefferis,—

Mr. Wickens spoke of mechanical stokers, etc. I want to say that, to a man that has had a few years experience along these lines that in 50% of the cases the disease is better than the remedy. Often enough these appliances work very nicely for a while, and then something goes wrong, which upsets your efficiency and results and increases total cost. If your plant is working continuously, say with three shifts of men a day of 24 hours, you cannot shut your plant down to make adjustments and experiments, you have simply got to keep your plant running.

I understand that in some of the larger cities, such as New York and London, Philadelphia and Chicago and the larger commercial centres, there are consulting engineers who make a specialty along certain lines, and they are called in just the same capacity as a consulting physician. When a specialist is engaged the proprietor tells him he is prepared to spend so much money; if competent the specialist is able to tell him that for so much money he will get such and such results, so that the employer is warned ahead of time and knows exactly what results to expect before laying out his money.

Of course if the proprietor does not take any interest in the plant there is not the incentive for the engineer to improve himself and look after his plant as he should, and after a while he becomes indifferent and lazy, letting things go and making the other fellows look after things that he should look after himself. Of course this is wrong, and can only lead to one end, dismissal. There should be friendly rivalry among the men to try and get the best there is out of the plant and keep it in as good a shape as possible, but at the same time operating engineers should not be blamed for a poor installation which is often the cause of a great deal of trouble.

Mr. Wickens,—

I have very much pleasure in proposing a vote of thanks to Mr. Kastella for his paper which has brought out such an excellent discussion.

Mr. Hardisty,—

I second that.

Chairman,—

It has been proposed by Mr. Wickens, and seconded by Mr. Hardisty that a very hearty vote of thanks be tendered to Mr. Kastella for the splendid paper he has given us to-night. What is your pleasure? Carried unanimously.

Mr. Kastella,—

It gives me great pleasure to be with you to-night and I hope in the near future that I shall have an opportunity of meeting you again, and the excellent reception that you have accorded my paper has amply repaid me for the time I have spent in writing it, and I can say that should you at any future time call on me to give you another paper I shall have great pleasure in preparing one.

Mr. Jefferis,—

I have been asked in the absence of Mr. Bannon to present our retiring President, Mr. Baldwin, with this little charm.

I think it is rather unfair to ask a man to make a speech at five minutes notice. However, I just want to say to Mr. Baldwin, what I know every other member of the Club feels, and that is, that he has filled the chair, I think, a little better than any of the Presidents who have preceeded him. Personally I have a very sincere regard for Mr. Baldwin for the straight forward manner in which he has fulfiled his arduous duties. The success of the Club during the past year has been entirely due to his untiring efforts, and we hope, Mr. Baldwin, that you will wear this, and that all your undertakings in this life will be as pleasant and as successful as your year as President of this Club. We hope, sir, as the years roll by you will look at this little charm and think with pleasant memories of the times associated with it and think of us all kindly as your friends.

Chairman,—

Mr. Jefferis and Gentlemen,—I have been a member of this Association from its inception, in fact as I hold the first membership card marked No. 1, I feel (though not in years) the "Daddy of the Club." And during my membership it has been my endeavor to advance the interests of the Club and I feel proud when I think what a splendid organization we have, and I now assure you that I will continue to do my best to assist in maintaining its good reputation.

With reference to this very pretty Jewel or Charm which you have so kindly presented to me, I may say that my predecessors in this Chair have been presented with a Jewel, and I was egotistical enough to feel that as I had done my best, you would be warranted in treating me in a similar manner. I had prepared a short speech to be given on vacating the Chair, but after listening to the very flattering remarks of Mr. Jefferis, "the wind has been taken out of my sails", so I must conclude by thanking one and all and especially the Secretary for the able assistance and courtesy received, I also wish the Club continued success and which I am safe in saying will be ably sustained by the incoming President, Mr. Jas. Bannon. I thank you.

Moved by Mr. Wickens, seconded by Mr. Fletcher that the meeting be adjourned. Carried.

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