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THE CENTRAL RAILWAY AND ENGINEERING CLUB OF CANADA

OFFICIAL PROCEEDINGS FOR JANUARY, 1912

CONTAINS:—

REPORT OF JANUARY MEETING

AND

PAPER ON "MOD[illegible] STEAM POWER PLANT AND ITS [illegible]PLIANCES"

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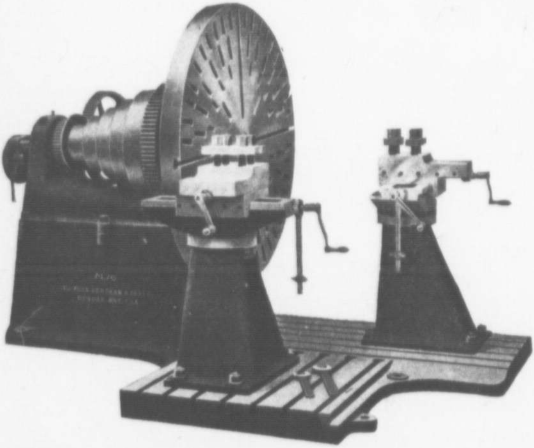

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PROCEEDINGS OF THE CENTRAL RAILWAY AND ENGINEERING CLUB OF CANADA MEETING.

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.
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B. Riordan	W. R. Gardner.	J. G. Abraham.
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J. E. Rawstron.	H. G. Fletcher.	J. Herriot.
J. M. Clements.	E. A. Wilkinson.	H. H. Wilson.

R. S. Coxon.
J. Wright.
J. Douglas.
C. F. Nield.
F. Wickson.
R. B. Shepherd.
E. Hebdon.
J. W. Walker.
J. Barker.
L. S. Hyde.
D. Cairns.
R. Pearson.
G. Baldwin.
G. Black.
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 $\frac{20}{1.5}=12.5$ 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.

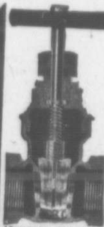
I think it is rather unfair to ask a man to make a speech at five minutes notice. However, I just want to say to Mr. Baldwin, what I know every other member of the Club feels, and that is, that he has filled the chair, I think, a little better than any of the Presidents who have preceeded him. Personally 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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