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

OFFICIAL PROCEEDINGS

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

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

ROSSIN HOUSE, TORONTO, February 18, 1908.

The President, Mr. McRae, occupied the chair.

Chairman,—

We will call the meeting to order. The first order of business is the reading of minutes of previous meeting.

You have all been supplied with copy of minutes of last meeting, and in order to proceed it will be necessary for some person to move that these minutes be taken as read.

Moved by Mr. Jefferis and seconded by Mr. Fletcher, that the minutes be taken as read.

Chairman,—

At our last meeting I appointed a committee to see if it were possible to secure better quarters for holding our meetings. As you know that the proprietors of this hotel prohibit smoking in these rooms. The members of this committee inspected several rooms where meetings might be held, but were unable to locate one suiable for our meetings. They then interviewed the proprietors of this hotel, with the result that they have consented to allow smoking in this room. They also consented to make better arrangements for lighting, which you see has been done. Therefore, we have decided to remain where we are at present. I might say here that the proprietors and members of the Reception Committee request that no lighted cigars are thrown on the carpet. However, you can throw all the ashes you wish, but do not burn the carpet.

Chairman,—

The Executive met this evening previous to the regular meeting and one of the propositions that was brought before it was the holding of an entertainment on the next meeting night. The Executive decided that we would hold an entertainment on the next meeting night, but it will not affect the regular proceedings of the Club on that night. We will open the proceedings at eight o'clock as usual, with a short paper, and then adjourn to the dining room and proceed with the amusement programme. The expenses will be borne by the club on this occasion. You will remember last year the members stood one half of the expenses and the Club the other half. However, this year the Club intends to defray all the expenses.

We propose to have some musical talent and some speakers, and we trust that the members will come out in force and bring their friends with them. We trust that this meets with the approval of the Club.

Moved by Mr. Burrows, seconded by Mr. Tushingham, that the thanks of the Club be tendered Messrs. Nelson Bros., for their kindness in re-arranging the room and consenting to the members smoking therein.—Carried.

Messrs. Campbell and Lewkowiez were appointed a Committee to tender the above to the Proprietors.

Chairman,—

The next order of business is the announcement of New Members, which I will call upon the Secretary to read:

LIST OF NEW MEMBERS.

Mr. J. C. Armer, editor Canadian Machinery, Toronto.
Mr. W. E. Archer, Chief Engineer Nasmith Co., Toronto.
Mr. W. C. Tait, Smoke Inspector Stationery Engines, Toronto.
Mr. H. H. Wilson, Chief Engineer W. A. Murray Co., Toronto.
Mr. W. H. Plummer, General Yardmaster, G. T. Railway, Stratford.
Mr. J. A. Roe, Machinery Supplies, Detroit, Mich.
Mr. T. A. Sperry, Routing and Premium Supt. Canada Foundry Co., Toronto.
Mr. H. O. H. Eddrup, Chief Clerk, General Foreman's Office G.T.R., Toronto.
Mr. J. H. Morrison, Rep. Fedral Clay Product Co., Toronto.

Chairman,—

Your Executive have considered the applications of the gentlemen just read by the Secretary and have decided favorably upon same, and they, therefore, become members of the Club.

In connection with this I might state that the small number of new members secured for this year has been rather discouraging. It seems to me that if the members of the Club were to exert themselves to some small extent, our membership might be considerably enlarged. I trust you will all do what you can towards securing new members. The Secretary will be pleased to supply you with the necessary forms upon which to make application.

Chairman,—

The Secretary is in receipt of a letter from our Past-President, Mr. Kennedy, which reads as follows:

Mr. C. L. Worth, Secretary and Treasurer,
Central Railway and Engineering Club,
Room 409 Union Station, Toronto.

Dear Sir,—I am in receipt of your personal letter of the 27th inst. I regret very much that I was unable to be at the last Club meeting. I shall appreciate it very much if you will convey to the members of the Club my thanks for their thoughtfulness and kindness in presenting me the beautiful watch charm. I assure you it will be worn with the recollection of the many pleasant evenings spent with the Club.

Wishing the Club every success in the future, and hoping that I may have the pleasure of attending one of the meetings before long, I am,

Yours truly,
W. KENNEDY.

MEMBERS PRESENT.

Acton Burrows.	H. W. Cook.	H. E. Rowell.
O. A. Cole.	W. R. McRae.	I. Jefferis.
J. J. Fletcher.	Geo. Shand.	W. E. Archer.
J. H. Cook.	W. Price.	J. M. Clements.
J. H. Morrison.	H. G. Fletcher.	A. Hallamore.
T. A. Sperry.	J. F. Campbell.	H. H. Wilson.
J. Duguid.	J. W. McLintock.	W. H. Bowie.
Geo. Mott.	K. D. Clark.	A. G. McLellan.
A. J. Lewkowiez.	C. M. Murray.	H. Cowan.
Geo. F. Lilley.	Geo. Black.	A. M. Wickens.
D. C. Hollowell.	F. Tushingham.	J. Mooney.
John W. Griffin.	J. C. Garden.	J. D. Scott.
J. R. Armer.	S. W. Price.	Albert Attle.
Geo. McIntosh.	A. Taylor.	I. O. Frost.
J. McWater.	D. Campbell.	R. Pearson.
T. J. Ward.	James Reid.	J. J. Millen.
S. Turner.	P. Boylan.	C. L. Worth.
C. A. Jefferis.		

Chairman,—

We have with us to-night Professor Bain, of the Toronto University and a member of the Faculty of Applied Arts, who has consented to give us an address on "Oils and Lubricating." I have much pleasure in asking Prof. Bain to come forward and take the floor.

OILS AND LUBRICATING.

BY PROFESSOR BAIN, OF THE UNIVERSITY OF TORONTO.

Gentlemen: It is with some misgivings that I have undertaken to-night to speak to a Club of Engineers on one of the subjects on which they are deeply interested, viz., oils and lubricants, because in the first place, I feel that you are dealing with this subject more often than I am. You probably have to do with the subject many times in the week from a practical point of view, whereas it is not often my lot to take it up more than once or twice a month. By congregating together like this we get the benefit of interchanging our ideas with one another, and very frequently our best inspirations come in this way, and it is sustained by this feeling that I have undertaken to speak to you on this somewhat difficult subject.

I have a very good friend in Toronto who is an Engineer, and occasionally I have a chat with him about various matters, because my work is not directly on engineering, and I therefore speak more as a chemist. He has asked me several times, and I have discussed with him on various occasions, the question of the valuation of lubricating materials. I dare say that his ideas are much the same as most of those here to-night. The problems that bother him are much like these. He says:

"I am using P.R.S. engine oil (I may say my friend is a stationery engineer) because it is giving me excellent results. Now the Superintendent comes along and says that a traveller came to him the other day with a certain oil 10 cents cheaper than that being used, and he wants to find out whether it is worth trying." My friend says he can find out whether the bearings run cool, but it is pretty hard to say whether the new oil is as good or better than the old oil. He then asks me, "If anybody asks you about an oil, how do you tackle the problem? You may go about it in one way and I in another, and in all likelihood we all reach the same result. However, if we know how you go about it and I go about it, we will be that much further ahead."

An ideal way, I presume, of testing the relative values of oils or lubricants of any nature, would be the following:

First of all we would take a bearing and see whether it was in first class mechanical condition. Then we would have the shafting equipped with some means of measuring the power that was being transmitted. Having our bearing ready we use as a lubricant, one of the oils to be tested. We would have to let the bearing run for some considerable time before we would get the necessary information from our experiment, because, as you all know, certain oils and lubricants will, after they have been in service some time, begin to gum, but this may not develop before three or four days. Then we have to take into consideration how the oil affects the bearing. Some oils which may be excellent at the beginning, may corrode at the end of two or three weeks. Now, I want to point out that it is a hard matter to make a proper test, and tests of bearings equipped with dynamometors and involving these examinations are consequently only made at intervals by large consumers, and often they are forced to resort to other methods.

Now, I shall try and tell you, in a short way, how the large consumers obtain these results. I may say in the beginning that the largest consumers of oils in America, or in fact any other country, are the railroads. We have in America some railroads that employ a staff of chemists who test the material being used by that firm. You all know that the New York Central, B & O., and Chicago Northwestern all employ chemists in order to check the material they are buying and using. These chemists hand over their results of tests to the heads of the railroads for their guidance.

Now I am going to take up several of the methods used in testing oils, and I may say I am only following the lead of large laboratories. I shall take these up under a number of different heads, and as we go along I am going to talk to you in an informal way, and if there are any points which I may not make clear, I hope you will not scruple to interrupt me and have the matter made clear.

The first point in my mind, and one which, perhaps, is easy to settle, is the presence of dirt or grit in oil. Now, this is not as simple a matter as one might think, because some oils which I have myself examined, are smooth, and apparently clean, yet when they are carefully tested, considerable grit is found. This test may be made in an easy fashion. All you need to do is to take a small sample of oil, say one half wine glass full, and then add gasolene until it becomes quite fluid. You then take this solution of oil and filter it through a filtering paper, or ordinary blotting paper will do as well. You simply curl the filtering paper into a sort of cone and let the gasolene run into some vessel below. After this is run through, it is well to add a little more gasolene, and then wash out the oil which sticks to the paper, and then you have a record of the material which has been retained. Now, if there is any appreciable amount of dirt you will find it on the blotting paper. It is easy to apply and you can very often settle, in the course of a few minutes, whether some samples are cleaner than others. The first test then is to satisfy ourselves that the oil is free from mechanical impurities.

The second point which I wish to take up is the problem of gumming, and this is almost equally as easy to settle. One takes a small flat dish or saucer and pours into this dish a quantity of oil. It is then allowed to stand in a warm place for, perhaps a week. A good place in ordinary practice, is on top of a boiler. At the end of that time you lift the oil down and examine it carefully. There should be no scum on top. Oils that gum do so because they absorb from the air, oxygen. In the words of the chemist, it oxidizes.

The third test is one which I must say a word or two about. In the examination of oils we must always remember to take into account the purpose for which they are going to be used. For example, if we are going to use a grease for locomotive axles, the properties of that grease must be different from those of an oil which we are going to use for indoor use for high speed machinery. In other words, with oils which are to be used for outdoor work, the question of speed is a minor one, but for work in the engine room where high speed machinery is used, the question of safety in one of importance. When we are using oils in-doors, we must take into account the temperature, at which the oil gives off vapor. I may say the chief insistence on this point is made by the Insurance Underwriters. This test is probably familiar to you all, and is called the flash point test. It may be carried out by anyone of you with an apparatus which you can buy for a small price. The chemist uses for this purpose a small porcelain dish which he calls a crucible; a tin dish or metal dish will answer quite as well. Then you get a sheet of asbestos, cut a hole in the asbestos so that the crucible can rest in it, then you make a brass cover with two

holes in it. One of the holes should be large enough to admit a thermometer, and the other should be about one-half inch diameter. So far these materials will not cost you anything practically, but the most important thing you require is a thermometer and it is, I am sorry to say, somewhat expensive, as you have to buy something a little better than the ordinary article. It is a high temperature thermometer filled with mercury, and with this instrument, temperatures can be measured up to 550 degrees centigrade, which is somewhere in the neighborhood of 1000 degrees Fahr. A thermometer reading 400 degrees centigrade is quite ample for testing these oils, however. You can have any sort of stand on which to set up this apparatus. The crucible is filled up with oil to about one half inch from the top. You then put the metal cover on. Next you need heat. The best thing you can use for this purpose is a burner. I do not know that you all have burners handy. I have a type of burner here which we use extensively. It is a Bunsen burner. Your crucible is heated by means of this lamp. There is one important point which you must not forget; that is if you heat this oil too quickly, say in a minute, there will not be time enough for it to give off sufficient inflammable liquid to be detected. If you heat it very slowly, say taking four or five days, the inflammable vapor will leak away. Heat it so that the temperature rises about 15 degrees per minute. It is not difficult with a little practice to do this. You find as the oil gets hotter you will have to turn the flame of the burner down a little more. When the oil begins to get up to about 200 degrees centigrade, when you are working with engine oil, remove the cover from one of the holes in the lid and pass a match or taper across the opening. and at every five degrees rise you repeat that practice. At one temperature you will notice there is a little puff of flame, and then you immediately read your thermometer. That point is called the flash point, and this is the temperature at which the oil gives off the explosive vapor. It would be dangerous in large quantities. Underwriters are fairly unanimous in calling for a temperature of 350 degrees Fahn., or about 200 degrees centigrade. If the oil flashes above that point you may rest assured it is quite safe for indoor use. An oil that flashes below that point, however, you suspect. A low flash point almost always denotes that the oil has been adulterated by the addition of some more volatile lower grade material.

You remove the cover entirely now and continue the heating, passing the taper across the surface of the oil until finally the whole of the oil takes fire. That is the fire point. You may often find this mentioned in the specifications for oils. The fire point is not of such value as the flash point.

Having satisfied ourselves about the safety of the oil from this point of view, we pass on next to another important ques-

tion, viz., the question of the corrosive action of the oil upon the bearing. I may say that this is a somewhat difficult subject for me to treat here to-night, because the question of the acidity of the oil is left almost entirely to the chemist.

Perhaps you may know about the test with blue litmus paper which turns red in the presence of acids. This is, however, of practically no value in the case of oils. If your bearings are very badly corroded, have your oil examined by a chemist.

If the oil is blended, the test has less value as all of the vegetable and animal oils are acid in character. Here again we find that most specifications are very rigid. The acidity which is present usually in animal and vegetable oils, is due to a constitutent which we call oleic acid. It is present in considerable quantities in tallow. Most specifications call for oil which has no more than four per cent. of oleic acid. I cannot say much more about this.

The chemist first makes up a standard liquid by means of which he can determine the quantity of acid which is present. He then takes a sample of oil, perhaps two ounces, and he shakes this up with pure alcohol. The alcohol must be entirely free of acids. Then he adds to the alcohol a small quantity of dye stuff which we call an indicator. It is one color when acids are present and another color when they are not present. I have not brought any apparatus down with me to-night as it is hard to carry, and cannot, therefore, show you this fully; it is rather difficult to explain.

Having settled the acidity of the oil, we come next to the most important property of all. You know from your experience that if you have a bearing carrying a heavy load and running slowly, you use a very stiff lubricant. It may be solid grease. If you have a shaft running at high speed, you use a thin oil. Now the chemists call the property which makes the difference between the thin oil and the heavy oil, the viscosity of the oil. Therefore, one of the things which a chemist has to find out is the viscosity of the oils submitted to him. Now, in order to do that he makes use of an apparatus which determines the slowness of the flowing of an oil. Thin oil will pour out like water. These investigations on the viscosity of oils are made with a number of different instruments. There are probably about twenty different instruments in use in different parts of the world for measuring this property. It is a hard matter, therefore, to get comparative results as each large consumer specifies that the oil must be measured in a certain machine. There are two machines which are used in England and Germany. I have brought these two down to-night to show you what they are like. The Engler machine is used in Germany. You can regulate the temperature quite easily with this machine. I might say here

that in all viscosity measurements the temperature is a very important factor. You must keep the temperature the same. Supposing the temperature is 60 Fahr., you allow the oil to run into a glass vessel on which is etched off 50 cubic centimeters. We have a stop watch in our hand and we watch the oil filling into the lower vessel, and when it comes to the mark on the glass, we stop the watch. The number of seconds which this quantity of oil takes to flow out gives you an idea of the viscosity or stiffness. Then if we take another sample and do the same thing, we find out the comparative values of each oil.

The Redwood machine is mostly used in Great Britain. The Admiralty test all their oils with this instrument. The important point about this machine is the orifice which you will find to be a piece of agate with a hole drilled through which the oil flows. This hole is carefully drilled and is of standard dimensions. Like the German instrument, it is tested, and if you wish you can get a certificate stating the dimensions. The upper surface of this little piece of agate has been made hemispherical, and it is closed with a metal ball hung on a wire; the operation is the same as with the German instrument. Thermometers are placed both inside and out. There are a number of viscosimeters on the market; one of the simplest that I know of is in use by the Pennsylvania Railroad. It consists of a glass tube with a small opening in the bottom through which the number of seconds it takes the oil to flow is noted. While their results are very valuable to themselves, yet they are of no use to anybody else. Among large companies they have viscometors of their own. However, I understand the American Society of Testing Materials have this matter under consideration, and perhaps in time we shall have these instruments uniform.

The viscosity of the oil is a difficult question for the reason that we have got to find out by actual experience after all, what viscosity is the best for our particular machinery. If you have got an oil which gives good results, then when you are buying more oil, try to buy an oil which has the same viscosity as the oil which you have been using, providing the price is satisfactory. There are two sides to this subject of viscosity. A very thin oil when it is applied to bearings, will form a film which is so thin that it can be squeezed out readily, therefore, it is of little value; a heavy oil causes a loss in power by internal friction.

The best information is obtained from practice, but there are at the disposal of those who care to follow the subject up, many records which have been collected in past years, and from which you can find out the viscosity of the oils which are best suited for the various purposes. As I have said before, this subject is rather difficult.

Perhaps I am not saying anything about the points which I should have submitted to you. Later on, if there is anything you should like to know, I shall be glad to answer.

There are several other points to which I must pass on. We are living in an age of adulterations as you know. When you let your child go to buy candy, it is no longer pure; the candy your children buy, instead of being made of sugar, is composed mostly of glucose. Luckily we have very little adulteration with bread and butter, yet we have our suspicions of meat sometimes. There are cases known in which very poor oils have been passed off on customers by adulterating same, which I propose to describe to you. If you take lye and boil it with vegetable oil, you will find it becomes soapy in some respects. It is somewhat like liquid soap. You can, therefore, see that a low grade fluid oil may be transformed into a viscous oil by the addition of liquid soap. This adulteration would pass unnoticed in most cases. These oils gum badly and are unsatisfactory. I am going to tell you how to detect this trouble. In order to make this test you require a solution of what chemists call metaphosphoric acid, and you take some of the oil, dissolve it in a little gasoline, and to this solution add a little of the acid solution, and if there is any soap in the liquid it becomes turbid, and is low grade. A good oil under these circumstances shows no change whatever or such a slight change that no one would notice it. I have never heard of an instance in Toronto, and I fancy the only places it is likely to occur is in large places like New York or London.

Then, there is another point which may be of interest to some of you. It is an important matter for those who use oil for machinery out-doors in severe weather. The test is quite simple, and is made by taking ordinary oil vial and filling it with oil. You then put a thermometer in it, and put it into some salt and ice. You will then notice that the oil becomes solid at a definite temperature. This test varies with different oils. The Russian oil has a very low freezing point; it is equally as good and free from objectionable constituents if it has been properly prepared as the American, its viscosity is the same.

Then there is another important feature to be noted in testing oil, and this it is difficult to speak about. It is what the engineer calls "body," and curiously enough we find in two samples of oil quite a different behaviour in this connection. For example, you might notice that a lubricating oil sometimes seems to have difficulty in adhering to the bearing. It behaves as though the bearing was covered with water and could not adhere. Animal and vegetable oils are more oily than the mineral oils. Mineral oil appears to be less valuable from a point of view of body, than the vegetable or animal oils, and for that reason the practice has grown up in later years of using blended oils, that is 80 per cent. vegetable and animal oils

and 20 per cent. mineral oil. I do not know of any way to discover this body but by practice. The only way to find out is to try it.

Now, I have been speaking so far of the properties of lubricants, and we have been using quite freely the words animal, vegetable and mineral oils. Now, I might take a few minutes to describe to you how some of these oils are prepared. In order to make this clear I might remind you that many oils are prepared from plants such as olive, castor and rape oils; some come from animals such as sperm and tallow oils.

There is one chemical property which these oils possess which enables us to distinguish them quite readily from those of mineral origin. In order to illustrate that I am going to take a sample of oil and to it will add some lye which you can buy at your grocer's. When these two ingredients come together, you will note the oil becomes white. Now, I am going to add to this oil, water, and then shake it up. You will note also a foam on top. All oils of vegetable and animal origin you will find become soapy, and consequently we can use them in the manufacture of soap. This is a simple test. In order to show you the difference in action upon mineral oil, I am going to take some mineral engine oil and do the same thing as I have just done with the vegetable oil. You will note now there are two layers—the water below and the oil above. You will see however, there is no soap at all in this.

The mineral oils are obtained as a by-product. They are prepared by distilling the crude oil; first comes gasolene in the manufacture of crude petroleum. Then the burning oils, such as ordinary kerosene; next lighter lubricating oil, and as the temperature in the still arises, the oil becomes thicker and thicker until we get very stiff mixture, which is used chiefly as cylinder oil.

The methods employed in the purification of the various by-products are complicated, and I cannot stop to describe them.

Vegetable oils are broken up by soda lye into two constituents; one of these constituents you are all familiar with—glycerine. If you put animal or vegetable oil into a cylinder where the temperature may be 500 to 600 degrees Fahr., the high temperature has the same effect on the oil as the lye; in this case the oil is broken up, and the fatty acid immediately gets to work and attacks the metal. On the other hand, the vegetable and animal oils are excellent lubricants. They have the objection, however, of becoming gummy, whereas mineral oil can be left standing in a dish for a long time without this occurring. With animal and vegetable oils, they cannot be used over and over again as they become stiff and gummy. Then another point is that vegetable and animal oils have more body than the mineral oils and for that reason modern manu-

facturers are in favor of compounding these two classes by mixing them.

Now I think I have said about all I had come prepared to say. Other points may occur to you which I have not touched on, and perhaps, as I have already remarked, when I sit down, if some of you will ask questions, we will get on faster than if I stand here any longer speaking.

Chairman,—

I would like to ask Professor Bain if there are any electrical tests of oils for lubricating purposes, having in mind the current carried.

Professor Bain,—

By that you mean the creeping properties of the oil in carrying current?

Chairman,—

Yes. It is a well known fact that mineral oils have a higher resistance than other oils.

Professor Bain,—

There are, as you know, general methods of testing the resistance of the oil. I know animal oils have been used in transformer tanks, however, I have not had any occasion to investigate this and cannot say much on the subject.

Mr. T. A. Sperry,—

The Professor has covered the oil proposition pretty well, but has left out any discussion on graphites. I should like to hear from him on that question.

Professor Bain,—

I forgot to mention to-night when I started, that I would not talk on the subject of solid oils. I know very little about them. The only interesting thing I know in connection with this subject is the discovery by Acheson at Niagara Falls of the possibility of suspending graphite in water. This method of using graphite has not been sufficiently long in practice to allow data to be accumulated about it. At least I am not familiar with such.

Mr. H. H. Wilson,—

How can you tell, in a simple way, when oil is worn out, and when it is not advisable to use it any longer?

Professor Bain,—

Do you find that you do not get the same satisfaction with it as in the commencement?

Mr. H. H. Wilson,—

Yes. One might think that there was dirt in the oil or that the bearings were set up too tight. I wish to know how can we have proof that the oil is worn out or not.

Prof. Bain,—

That problem, I think, I should tackle in this way. If you were satisfied that the oil is clean, you can therefore dismiss that point from mind. Then you next find out whether the oil is acid or not, but this is rather difficult for you to determine yourself. I might suggest that if you go to the Central Electric Co., and buy a pipette and fill it with oil, and after taking the temperature of same, hold the pipette up, allowing the oil to flow out, then note the number of seconds it requires for the oil to drain. If the oil has been in use for sometime, make the test again, and if the oil has been kept in good condition, the number of seconds should be almost the same. That is, the viscosity of the oil should be the same. By the way, I would advise you, in the start, not to make one test only, but make two or three, as you will find slight variations.

There is another thing which I forgot to show you. It is a modernization of the flash point apparatus, and is now the standard on the German railroads. Everything is done with this machine in a mechanical operation, and there is less likelihood of variation in the results as by the other methods.

(Apparatus described).

By this means it is easy to get the flash point, but by other methods the flash points may vary somewhat.

Mr. A. J. Lewkoweiz,—

There is often difficulty in getting oils to properly lubricate thrust bearings. An emulsion of oil and water has been successfully used, where the oil alone failed.

Professor Bain,—

In that case, of course, we could hardly examine the viscosity of such a mixture. Such cases in ordinary practice, are somewhat of an exception. Probably the best scheme for lubricating bearings is in use at Niagara Falls in the turbines; that is, of forcing the oil in. Mineral oil for low pressure gives the best results, and vegetable and animal oils for heavy pressures give the best results. Complete examination of an oil can probably be best carried out by making an actual test of the oil on a bearing. So much data has been collected that it is easy for one to decide whether a certain lubricant is desirable for a purpose or not. If anyone is interested in this subject, there is an interesting book edited by Mr. Gill, The Analysis of Oils. He gives you a description

of how these tests are carried out. I, myself, find this book very useful.

Mr. J. C. Garden,—

There is a matter which I would like to ask the Professor. We have experienced trouble with our air compressors due to explosion in the air compression cylinder when the temperature is very much below the flash point of the oil we are using. Is there any possibility of the oil, in conjunction with the air, producing this explosion?

Prof. Bain,—

The temperature of the inside of your cylinder must be pretty high sometimes, just at the end of your compression stroke.

Mr. Lewkoweiz,—

In the case of the compressor, I do not think it is the oil which causes the explosion, but I think it is due to the gas formed by the evaporation of the oil within the cylinder.

Prof. Bain,—

The flash point is due to giving off light oils which are turned into vapor.

Mr. H. H. Wilson,—

There have been remarks made about lubricating enthrust bearings. Sometime ago I heard a discussion along that line. A great deal of trouble was found in the oil channels. One side of the shaft the oil would run in allright, but on the other side of the shaft the oil would not run at all. I would like to hear some mechanical man say something about this.

Mr. A. M. Wickens,—

In answer to Mr. Wilson's remarks, I think forced lubrication would be the best way to overcome the trouble. There must be some special condition under which your shaft is running. In latter day practice if there is any trouble in supplying oil to the journals, a little forced oil is used, with a result that the oil goes all over your journal.

Mr. H. H. Wilson,—

I confined my remarks to the enthrust bearings. On one side of the shafting the oil would flow through the oil channel allright, but on the other side it would not go down.

Just before coming here I was looking up a book on graphite and in that book I noted the very same thing is mentioned and pictured. However, I did not have time enough to read it up.

Mr. A. M. Wickens,—

There is one thing about distributing oil for a journal. There is no journal which will spread oil itself unless you help it. What you should do in all these cases it to put proper oil grooves in your journal and by that means they will spread the oil over all the box and it will touch every portion of your shaft, but the groove must be put in properly. In order to place your grooves right you must have an idea of the direction of the flow of the oil and the direction in which the shaft is revolving. Where the oil grooves are placed properly, there is no difficulty in lubricating the journal.

Chairman,—

In taking care of the lubrication of a horizontal journal, there is a little difference from the lubrication of an end thrust.

Mr. H. H. Wilson,—

I think Mr. Wickens' remarks are good. If we can inject the oil by means of channels through the thrust block casting to the point near the center shaft before it comes in contact with the bearing surfaces the same way as we oil crank pins of reciprocating engines, the oil then would be wiped out by the bearing surfaces themselves or due to centrifugal force.

Chairman,—

Gentlemen, the time for discussion has now expired. The Club to-night has listened to one of the most interesting discussions given since its inauguration, and for presenting such an interesting paper we have to thank Prof. Bain. Therefore, it will be in order for some one to move a vote of thanks to Prof. Bain.

Mr. Acton Burrows,—

I think it is very kind of the Professors of the University to give us so much of their valuable time in coming here to address us as Prof. Bain has done to-night, and I beg to move a vote of thanks to him for the very interesting lecture he has given us.

Seconded by Mr. Fletcher.

Chairman,—

On behalf of the Club, I have to extend to you, Prof. Bain, this vote of thanks.

Professor Bain,—

Mr. President and gentlemen, I thank you very much for the vote of thanks. As I said before, I came here to-night with a great deal of diffidence to speak to you about a subject which is rather difficult. If I have made myself plain I shall be satisfied.

Chairman,—

In connection with the proposed entertainment on the next meeting night, it is the desire of the Executive that the members of the Reception Committee meet at the end of this meeting.

Moved by Mr. Black, and seconded by Mr. Fletcher, that the meeting be adjourned.

NOTICE.

The regular monthly meeting of this Club will be held in Room 192, Rossin House, on the evening of March 17th, at 8 o'clock sharp, when a paper will be read on "The Origin of Societies" by Mr. Geo. Baldwin of the Canada Foundry Co., Toronto.

At 8.45 P.M. adjournment will be made to the Dining Room where the balance of the evening will be devoted to the entertainment of members, their friends and prospective members, for which no charge will be made.