

PAGES

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PROCEEDINGS OF THE CENTRAL RAILWAY AND
ENGINEERING CLUB OF CANADA MEETING

COURT ROOM No. 2, TEMPLE BUILDING,

TORONTO, September 23rd, 1913.

The President, Mr. A. W. Wickens, occupied the chair.

Chairman,—

I welcome you all back to our Winter Campaign. Our meetings having been off since May last. We had our picnic, which every one enjoyed. I am disappointed to see such a few of the members here to-night, but we will try and have a good meeting with those who are here. The first order of business is the reading of the minutes of the last meeting, and it will be in order for some member present to move that the minutes be adopted as read.

Moved by Mr. Baldwin, and seconded by Mr. Herriott.

Chairman's remarks,—

I want to impress upon the members that they may bring a friend with them. These meetings are opened for the purpose of diffusing knowledge, and your friends are just as welcome as you are, and every member of this club has a perfect right to bring a friend or two if they so desire. Bring them along and we will give them a right hearty welcome, and we will hope and try to make them members later on. I want the members to bear in mind that in future these meetings are going to be started on time at 8.15 p.m., as eight o'clock is a little bit early for people who live a long way off. Most of the members can be here by 8.15 p.m., and I hope members will bear that in mind and get here sharp on time. Then we shall have plenty of time to get through the business and have a good discussion of the papers. At the next meeting we will have a paper on Compressed Air, by Mr. McCabe of the Toronto Railway Company, and just exactly what line he will take up I cannot tell you, but it will be in the notice so that you will know exactly what it is, and you will no doubt get a thorough understanding of this matter. We shall have a paper in which almost every man is interested in some manner, so you must bear that in mind and bring your friends along. I think we shall have a good time, and it will be very interesting to us all.

I shall now call upon the secretary to give us the list of new members.

NEW MEMBERS

Mr. W. E. Ritchie, Engineer, Pickering, Ont.
 Mr. W. R. Hamilton, Machinist, Grand Trunk Shops,
 Stratford.
 Mr. W. Austin, Planer Fitter, Gurney Foundry, Toronto.
 Mr. W. Cooper, Planer Hand, Gurney Foundry, Toronto.
 Mr. P. W. Shill, Electrician, Christie Brown Co., Toronto.

MEMBERS PRESENT

Jas. Reid	J. H. Brundrett	W. S. Cowan
Geo. S. Powell	Geo. H. Boyd	C. D. Scott
H. Goodes	Stephen Pearson	R. Cherry
N. A. Davis	F. Smith	D. Campbell
J. McWater	James Wright	James Douglas
Geo. Baldwin	E. Logan	J. Fraser
Jas. Barker	J. Dewsbury	P. W. Shill
E. B. Fleury	C. H. Woodison	A. Harris
C. H. Stainton	T. B. Cole	Jas. Kelly
Jos. Callanan	G. Callanan	John Chambers
G. D. Bly	Chas. Russell	J. Chambers
G. A. Young	R. R. Murray	J. M. Clements
T. J. Walsh	Jas. Herriot	N. A. Davis
A. C. Heathcot	John Dawes	W. Evans
W. C. Sealy	C. De Grouchy	H. Fletcher
J. McIntock	G. M. Wilson	A. M. Wickens

Chairman,—

The next order of business is the reading of papers and the discussion thereon. We have with us to-night Mr. E. J. Woodison of the E. J. Woodison Co., Fire Brick, Detroit, Mich., who will read us a paper on "Firebrick in Cupola Practice." This is a very important paper and of general interest to a great many, and I trust it will bring out a good discussion.

I have much pleasure in calling upon Mr. Woodison.

FIREBRICK IN CUPOLA PRACTICE

BY MR. E. J. WOODISON, OF THE E. J. WOODISON CO., DETROIT,
MICH.

After this paper I may be like August the German. August ran a saloon in the Bowery in New York. One day while peacefully sunning himself in front of the saloon, the proprietor of the property came along and informed him that owing to the fact that the street was to be repaved, taxes were going to be advanced and as a consequent result, commencing July 1st, he would have to advance the rent \$25.00 per month. A little later in the day one of the bartenders, being appointed a committee of the whole, informed August that July first, owing to the high cost of living, they had decided they would have to have an advance of \$3.00 per week in their wages. Still later in the day the owner of the home which August rented up in the Bronx, came along and informed him that he would have to advance the rent \$20.00 per month, commencing July 1st, to all of which August gave a grunt. He went down the street, however, and came back with a placard which he placed over the cash register behind the bar. The placard read:—"July 1st will be the last day of August.

So I am inclined to say that after reading this paper it may be the last day of Woodison.

The subject which has been assigned to me is a big one, because it must be viewed from many angles. In this paper I am going to confine myself to cupola practice only, passing by malleable, steel and other furnaces used in the melting of iron all of which presents interesting problems.

First of all, let us consider what we have to contend with in the cupola. The answer, I think you will agree with me, is sudden heating and sudden cooling, the two of which means quick expansion and quick contraction.

It must of necessity be very refractory material that can range from a temperature of say 70 to 2,370 degrees (the necessary heat for melting iron to a white colour), in as short time as thirty minutes and then drop back to normal in a few hours.

There is an erroneous idea that friction does more harm than heat; this is wrong, as is evident by the blast furnace. A blast furnace makes, say 100 tons of iron per day, to accomplish this they must smelt 350 tons of iron ore together with the necessary amount of coke and limestone. Now, the blast

furnace runs continually for two, three, or four years without stopping, and the lining lasts until it goes out of blast, in other words, shuts down. It would therefore seem that friction has little to do with the life of a cupola lining. My contention is that the continual expansion and contraction disintegrates the lining with the result that it melts down or, when the bond is destroyed, spalls off.

In an experience of twenty-five years in the fire brick business, I have found that brick adaptable for oil furnaces under pressure, malleable iron bungs and such like work, when placed in the cupola do not work as satisfactorily as brick made especially for cupola practice, and yet more money frequently is paid for higher grades of brick. I say higher grades because it is conceded they are higher grade for some purposes, but not so for the cupola.

Cupola blocks and brick have to be very carefully handled in their manufacture to prove satisfactory in your practice. I have frequently seen good cupola blocks spoiled because they were hastily dried in the drying, instead of being allowed to remain on the drying floor until the moisture was well dried out of the same before placing in the kiln. Again, I have seen cupola blocks taken out of the kiln before they were properly burned, and those blocks would quickly spall off. All moisture should be thoroughly burned out, not green in the centre, otherwise it will not stand expansion and contraction.

I recall some years ago getting a new fire brick manufacturer to make cupola blocks for me. I told him how I wanted the mixture treated and cured. One time while at the works for a couple of days looking around, I found that they were not carrying out my ideas at all, that they were only allowing them to remain on the drying floor a short time, and owing to having considerable business were taking them out of the kiln before they were properly burned. Shortly after, I found quite a number of complaints from people who had purchased the material, and could readily understand why this was the case. It is surprising how little a great many fire brick manufacturers know about what is needed for cupola practice. Some of them figure that if they make proper sizes and of proper radius that that is all that will be required. As regards actual cupola practice their knowledge is very limited, and yet, as each of you know from your foundry experience, it takes a brick of exceptional ability to answer in a cupola lining. In my experience I have found that it was not necessary alone to educate the manufacturer into the actual component parts necessary, the method and length of time required in drying, but the way to place in kiln and burn.

One manufacturer who made cupola blocks for us for a long time placed the same over the fire arches. The result was

they were burned so hard that they would not expand and contract. He had to be educated away from that principle. Still another placed the cupola blocks in the top part of the kiln where they did not get fired enough and were soft, which meant that they were only skin burned. When they were placed in cupola after the heat had penetrated the surface they spalled off. He had to be educated away from that principle.

If I appear personal in making the following recommendation, believe me, it is not intentional. If you buy cupola blocks or brick, buy from someone who understands cupola practice. It does not follow that because a brick is a fire brick it will stand in your cupola.

Slag should be kept in a fluid condition by the use of limestone, oyster or clam shells or by fluorspar. A much better drop will be had and less chipping to do, this in turn means less labour in building up your bosh. Right here it might be well to admonish, don't build up your lining with clay if the hole is large enough to put in a piece of brick. Place the clay or daubing on thin and if possible gradually build the lining up to normal.

Using clay or daubing one inch thick is a poor method— as it dries, it contracts; cracks appear, and it spalls off.

In the selection of a proper refractory it would seem that the point to consider is securing a brick which will stand expansion and contraction and eliminate the question of friction.

See that your cupola tender lays the brick right, instead of plastering them in the cupola have him dip in clay mixture made to the consistency of molasses.

Keep your brick in a dry place. Some foundrymen leave them out in the weather. They go to pieces shortly after being placed in cupola and the brick is consequently condemned, not because it may not have been good, but because its efficiency was destroyed before it got in the cupola.

If perchance they did get wet too, and you have used them, then be sure to keep a good fire in the cupola for eight or ten hours to dry out moisture.

I would like to add here in parenthesis that in a talk with a foundryman at lunch to-day he asked if any harm would be done in leaving the firebrick out in the weather. I told him that many a good firebrick has absorbed the moisture when left outside, say in the fall and it rained or froze, and in a frozen condition was put in the cupola and it is impossible to get good results therefrom. That is equally applicable to any fire brick; if a firebrick is placed into a boiler or brass furnace, malleable iron furnace or cupola for eight or ten hours the moisture dries out and better results will be obtained than even if blast is placed in cupola or boilers.

Mr. Fleury, our Toronto manager, suggested to me to-day

that I carry out an idea of Mr. Worth's that the paper be enlarged, and that I touch on the question of placing of firebrick in the cupola. Now that would produce an argument, I fear, that it would take a whole lot of discussion to get through. It is a fact, however, that a great many foundrymen crowd their cupolas. Say if they have a cupola with a capacity of five tons they might crowd the cupola to eight tons. Now in order to do it they have to increase their blast and by increasing their blast they are simply burning out the lining and very frequently they condemn the firebrick when as a matter of fact it is not at fault.

If there are any questions that I can answer I would be very glad indeed to do so.

Chairman,—

Gentlemen—You have heard Mr. Woodison's paper, and he has very kindly volunteered to answer any question you may have to ask him. I presume that there will be a good many among you who are interested in firebrick, and I do not think there will be many questions that Mr. Woodison cannot answer. He is a man who has had a good many discussions with firebrick men all over the country, and I think he will be able to answer all questions. There should be a good discussion on this paper, and we are ready now for any of the members to take this question up.

Mr. Shill,—

Is there any trouble experienced with the pitting of the chemicals in firebrick when used in cupola.

Mr. Woodison,—

I should say not.

Mr. Shill,—

What experience have you had with brick you handle for furnace work.

Mr. Woodison,—

I would call your attention to the fact that any first class manufacturer should be able to give you a good soft brick high in silica and free from lime which would give you a very satisfactory brick for this class of work.

Mr. Baldwin,—

I would like to ask Mr. Woodison if he has had any ex-

perience with mica-schist, and another question I would like to ask is, and this may be simple to some, but I have charge of the building and rebuilding of a number of furnaces in our foundry, and it is information I am after, I want to know if we can tell by the look of a brick whether it is good, bad or indifferent. I would also like you to give us your unbiased opinion as to the best brick obtainable. Some little time ago we got a carload of fire clay, and we were told that we could leave it out in the weather, and that it would not hurt it at all. That does not reconcile at all with the remarks you made in reference to some of the bricks. I was just wondering if this had any reference to the brick that you deal in.

Mr. Woodison,—

I have had some experience with mica-schist. It is a very good refractory. The serious drawback, however, in its general use is that it is not mined, or rather it is not supplied to you in any given shape. You get it in very irregular shapes, and you ought to have a stone mason, and a stone mason of the old school at that, to take a look and prepare it for cupola practice.

Your second question as to recommendation of a fire brick is hardly a fair question. I am in the brick business, and I did not come down here to solicit business, but without mentioning any branch, if you could get a brick containing approximately 50% of silica and 53 or 54% of aluminum, not too coarse and medium burned, it should not make much difference whether it is from Jones or Woodison. It must be medium burnt. Now if it is too hard burnt it is going to spall off. If it is too soft burnt it will have a similar action, and just simply fall away with the slag. Any amount of you foundrymen who have had experience, particularly with large cupolas, will bear in mind the fact that your bosh burns out, and while it is true the blast is partially to blame for it. It is also a fact that a cupola in a great many instances the slag is allowed to accumulate and forms a bridge above the tuyere, so you can guess what happens. I have seen a cupola bridge right over, and after the bottom has been dropped the cupola is completely bunged, and if a brick is used the bricks will go with it.

Mr. Baldwin,—

You have not yet answered my other question in connection with leaving the brick out in the weather.

Mr. Woodison,—

I beg your pardon, but I overlooked that part. Regarding

the fire clay being left out in the weather, that will not do any harm as in order to be used you have to mix it in with water, but you do not treat a fire brick in the same manner. It is, of course, preferable to keep it under cover, if you keep it in the weather you would have to regrid it; that is not as nice as handling a dry clay itself. Have I answered you?

Mr. Baldwin,—

Yes.

Mr. Brundrett,—

I don't think you quite understood Mr. Baldwin's question in reference to mica-schist.

Mr. Woodison,—

I understand, Mr. Baldwin, that you would like to have my views on the use of mica-schist for filling in cavities in preference to fire clay.

Mr. Baldwin,—

Yes sir.

Mr. Woodison,—

In preference to mica-schist ground you would have to use some clay to hold it in. The clay will dry and crack, and very frequently fall out as you have experienced a number of times, thus losing the benefit of your mica-schist.

Mr. Baldwin,—

You did not quite answer me. Can you tell by the look of a brick whether it is good, bad or indifferent. Quite recently I built a furnace for our foreman blacksmith, not a cupola, and I built it with hard burnt brick. In a few days he complained about them running, and he was sure that it was caused by putting in too much fire clay in the joints. When repaired with soft brick it turned out much better. I asked the foreman the cause of this and he could not tell, so I was just wondering whether we could tell by the look of a brick whether it was good, bad or indifferent.

Mr. Woodison,—

If of course you have found a brick which was giving you satisfactory results for your furnace and that brick was not

hard burnt, the colour was light in appearance, why, you could reasonably figure, assuming of course that it is not too open a grain, that it would be a good brick for your furnace practice.

The hard brick which you put in your oil furnace certainly would not be satisfactory and the average cupola brick that you put in your oil furnace would be more satisfactory. You want a brick a little bit harder than you would in cupola furnace, and decidedly more porous. If you observed that furnace carefully the brick appears as though they were on fire all the way through. Have you observed that in your oil furnace? It is not as noticeable as in a coal furnace. You want an entirely different brick in an oil furnace than you would use in your coal furnace.

I had figured, but I would not mention any of my own branch of brick because I do not want to infer that I am using this meeting as an advertisement, and I will even refrain from doing that now. I will say this that at Detroit the Chalmers, Packard, Ford, Cadillac, and one or two other auto people who use a great many oil furnaces buy 50,000 to 60,000 of my brick at a time and the brick that we sell them is entirely different from those we sell for cupolas.

Mr. Brundrett,—

Do you not think that the biggest part of the trouble with the cupola brick is the very unevenness of the brick? It is very seldom that you get two cupola blocks that are of the same dimensions, one block will possibly be quarter of an inch higher than the other. You take one block and you will find it one-quarter inch thicker than the other, but the blocks you claim should not be different to that extent.

Mr. Woodison,—

You of course understand that in burning brick in a kiln some bricks are subject to more heat than others, which will account for the slight variation in size. In building any refractory it does not make much difference whether it is a block of fire brick. They are burned in kilns approximately 16 feet in diameter, and 12 feet high, four to six fire arches. Now, the block or brick that is nearest the arches is going to get the most heat, and the brick getting the most heat will be a trifle smaller than the brick placed in the upper part of the kilns where it does not get as much heat. Now there is some slight variation, but if you are getting more than one-eighth inch in variation you are not getting a well made brick, that is too much variation. It does not make any difference whether you are buying them from me or anyone else.

Mr. Boyd,—

You will not find it that way. One block will be one-quarter inch thicker at the back than on the front side.

Mr. Woodison,—

Not with some of the experiences that I have had, especially in good cupola block makers. I have not enlarged on my experiences, I have stated actual facts. The average fire brick manufacturer knows how to make fire brick, i.e., they know approximately the quantity of silica and aluminum which is necessary, and they do know how to make them so as to secure proper results and they can make the three dimensions which you give, namely height, breadth and length, but when it comes to placing them in the kilns and firing them and so on, they fall down, but I can say that we are now getting less than one-eighth variations.

Mr. Baldwin,—

I do not think that sufficient care is taken in the packing of bricks in the cars. More straw should be used.

Mr. Woodison,—

In some cases there is considerable straw used and in others they are very lax. Sometimes we have had them shipped and there has been no straw.

Mr. Baldwin,—

I have not found much difference in those coming from the Old Country and those from the States in the matter of chipping. That would be a good matter for Mr. Woodison to take up, i.e., the packing of the bricks.

Mr. Woodison,—

Mr. Fleury—the bricks that we have come to the Toronto plant, do they come in pretty good shape?

Mr. Fleury,—

Very good shape.

Chairman,—

Mr. Wright—can you say anything on this subject.

Mr. Wright,—

Mr. Douglas here is better acquainted with that than I. Perhaps Mr. Douglas will have something to say.

Mr. Douglas,—

I have nothing to say.

Mr. Wright,—

I would just like to ask Mr. Woodison how they manufacture bricks.

Mr. Woodison,—

At all manufacturers mills there are two processes, the wet and the dry. The wet is known as the slop mud brick, and the other dried brick, i.e., pressed with the clay in as dry a shape as they can, and pressed by machinery, hydraulic or hand drying press. They are taken from the press laid on a dry floor and allowed to stay there until all the moisture is got out, and then are transferred to the kiln.

Mr. Baldwin,—

Mr. Boyd is with us. He has been several years in the foundry business, and is just retiring from the business in the course of a week or so. Surely he can ask some questions.

Mr. Boyd,—

With reference to the unevenness of brick; is that caused in the burning of the brick?

Mr. Woodison,—

Does the question you are asking allude to different bricks of the same manufacturer or two different manufacturers.

Mr. Boyd,—

Bricks made by the same manufacturer.

Mr. Woodison, —

They might be hard or soft burned which would make the difference.

Mr. Baldwin,—

I think Mr. Woodison we will have to try your brick, and get you to come around in twelve month's time.

Mr. Boyd,—

I would like to ask Mr. Woodison if there is any inspection made of the fire brick.

Mr. Woodison,—

Yes, where I have my fire brick made.

Mr. Boyd,—

You would naturally think that if the brick is not burned properly that the brick would be put back in the kiln.

Mr. Woodison,—

That would be a very expensive proposition. The trouble is in the average brick, they are worked with a lot of unintelligent labour. The cheapest kind you have in your foundry are the cheapest we have in a brick plant. They do not appreciate what is necessary in the brick to get certain results, that is where I have had serious trouble, and I have had to go down there a number of times to impress upon them to have the brick placed in a certain position in the kiln. The cost of your building contract is several times the cost of the firebrick. The cost of your firebrick alone is very small compared with the labour of putting this brick in place.

Mr. Boyd,—

That is my reason for asking.

Mr. Woodison,—

All bricks are inspected.

Mr. Boyd,—

Can you give us an idea of what the price of a good cupola block would be. I do not mean your own kind, but an average kind of the ordinary run of the different manufacturers, say 72 inch cupola, 9x6x4 block, or No. 4.

Mr. Woodison,—

Assume 72 inch in the cupola, 6 inch wall, 4 inch high; such a block should cost approximately \$60 a thousand, for an A-1 block.

Mr. Goods,—

What difference will the blast make in a cupola.

Mr. Woodison,—

A very decided difference. If you are going to use 8 oz. pressure your brick will last you considerably longer than if you use 12 oz. to crowd your cupola.

Mr. Baldwin,—

Mr. President, I would like to move a very hearty vote of thanks to Mr. Woodison for the paper read, and the discussion we have had. We have all profited by his remarks, and also by the paper that Mr. Woodison has very creditably handled. I feel confident myself that Mr. Woodison knows what he is talking about or he would not have come here. I move a very hearty vote of thanks to Mr. Woodison.

Seconded by Mr. Boyd. Unanimous.

Mr. Woodison,—

Mr. President, I am very glad I have come, and I thank you very much for the vote of thanks which is appreciated, and if at any time I can dig up any subject and give you any information I should like to know it, and I shall be pleased to give you all the information I can. I hope you will accept my paper in the spirit in which it is intended. I thank you all.

Moved by Mr. Barker, seconded by Mr. Bly, meeting be adjourned.

The thanks of the Club are due to the following who so kindly donated prizes which were competed for at our Annual Picnic held at Erin on June 21st, 1913:—

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