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CANADIAN MINING & MECHANICAL REVIEW

CONDUCTED BY - - - - - - B. T. A. BELL.

OFFICES:
Victoria Chambers, 140 Wellington Street,
OTTAWA.

Vol. XII. MARCH, 1893. No. 3.

# THE INTERNATIONAL MINING CONVENTION

## At Montreal.

The sixty-fourth meeting of the American Institute of Mining Engineers opened at Montreal on Tuesday evening, 21st February. Conjointly with the Institute there assembled the General Mining Association of the Province of Quebec, the Mining Society of Nova Scotia, the Provincial Mining Association of Ontario and the Asbestos Club. By kind permission of the Governors the various meetings were held during the week in the spacious and beautifully equipped lecture halls of the new Physics Building, at McGill University, on Sherbrooke Street.

It was originally intended that the opening proceedings should take the form of a reception by their Excellencies, Lord and the Lady Stanley, of Preston. Owing to the severe illness of one of his sons, necessitating the hurried departure of Lady Stanley for London, this feature, however had to be abandoned at the eleventh hour. The occasion was robbed of a good deal of interest too by the absence of the Hon. T. Mayne Daly, Minister of the Interior, Ottawa, the Hon. W. S. Fielding, Premier of Nova Scotia, (who was detained by a snow blockade) and the Hon. E. J. Flynn, Commissioner of Crown Lands, Quebec. These gentlemen had promised to deliver addresses but their parliamentary duties were found too pressing to permit their attendance. However, thanks to the courtesy of His Worship, the Hon. A. Desjardins, Mayor of Montreal and Madam Desjardins, who very kindly came to the rescue on a moment's notice, the evening's programme was carried out. The attendance of delegates in consequence mainly of the detention of trains was not so large as anticipated, the members of the Mining Society of Nova Scotia and many others being unable to reach the city until Wednesday morning.

The official register of attendance during the week was as follows:—

Adams, Capt. Robt. C. Anglo-Canadian Phosphate Co., Montreal.
Ayres, W. S., civil and mining engineer, Kenvil, N.J.
Ayres, Mrs., Kenvil, N.J.
Allan, W. A., Little Rapids Mining Co., Ottawa.
Allison, Robt., Franklin Iron Works, Port Carbon, Pa.
Allison, Mrs., Port Carbon, Pa.
Adams, F. M., Adams & Davis, New York.
Archibald, Charles, Gowrie Coal Co., Cow Bay, C.B.
Archibald, the Misses, Cow Bay, C.B.
Archbold, James, Scranton, Pa.
Archbold, Mrs. and the Misses, Scranton, Pa.
Addie, G. K., Sherbrooke, Que.

Barnard, F. S., M.P., Victoria, B.C.
Barnard, Mrs. F. S., Victoria, B.C.
Barnes, Geo. T., Philadelphia, Pa.
Barnes, Mrs. G. T., Philadelphia, Pa.
Boyd, H. A., Buffalo, N.Y.
Bagg, Mrs. Dr., New York.
Blake, Theo. A., New York.
Blake, Wm. P., Shullsburg, Wis.
Blake, Miss C. H., New Haven, Conn.
Barnes, Edward, Sunderland, England.
Blue, A., Director of Mines, Toronto.
Buck, F. P., Dominion Lime Co., Sherbrooke.
Birkinbine, John, Philadelphia.
Bell, B. T. A., CANADIAN MINING REVIEW, Ottawa.
Bell, James, Arnprior, Ont.
Bell, Dr. Robt., Geological Survey of Canada, Ottawa.
Bell, Mrs. Robt., Ottawa.
Burchall, Jas. T., Sydney Mines, C.B.
Burchall, Mrs., Sydney Mines, C.B.

Cleghorn, J. Raymond, Philadelphia, Pa.
Cleghorn, Miss Mabel, Philadelphia, Pa.
Cleghorn, Mr. Clarence, Philadelphia, Pa.
Cleghorn, Mrs. Clarence, Philadelphia, Pa.
Coleman, Prof. A. P., Toronto, Ont.
Carriere, C. H., Levis, Que.
Chown, Chas. D., Kingston.
Circkel, C., Templeton Asbestos Co., Templeton, Que.
Cameron, Ian., Dominion Mineral Co., Sudbury, Ont.
Conyngham, J. N., Wilkesbarre, Pa.
Conyngham, Mrs., Wilkesbarre, Pa.
Conyngham, Col. C. M., Wilkesbarre, Pa.
Conyngham, Miss, Wilkesbarre, Pa.

De Camp, Mr. W. S., New York.
De Camp, Mrs. W. S., New York.
De Camp, Miss, New York.
Day, Dr. David T., Washington.
Day, Mrs. David T., Washington.
Day, Mrs. W. C. Sworthmore, Pa.
Dowling, D. B., Geological Survey, Ottawa.
Drummond, G. E. Canada Iron Furnace Co., Montreal.

Egleston, Prof. T., Columbia College, New York.
Eustis, W. E. C., Eustis Mining Co., Boston.
Evans, A. M., King Bros. Asbestos Mines, Black Lake, Que.
Ells, Dr. Robt., Geological Survey, Ottawa.

Fergie, Chas. Drummond Colliery, Westville, N.S.
Futvoye, J. B., St. Johns, Que.
Fielding, Hon. W. S., Halifax, N.S.
Francklyn, G. E., General Mining Association of London, Halifax, N.S.
Franklyn, Mrs., Halifax, N.S.
Fraser, Graham, New Glasgow Coal and Iron Co., New Glasgow, N.S.
Franchot, S. P., Emerald Phosphate Co., Buckingham.
Franchot, Mrs., Buckingham.
Faribault, E. R., Geological Survey, Ottawa.
Francis, Lewis W., Port Henry, N.Y.

Garrison, F. Lynwood, Philadelphia.
Gue, T. R., Acadia Powder Co., Halifax.
Garvin, J. M., Rock Run., Alabama.
Greene W. H., Philadelphia.
Giroux, N. J., Geological Survey, Ottawa.

**John Birkinbine, M. E., Philadelphia, Pa., President American Institute of Mining Engineers.**

Howe, Dr. Henry M., Boston.
Howe, Mrs. H. M., Boston.
Hines, Samuel, Scranton, Pa.
Hines, Mrs. Samuel, Scranton, Pa.
Haycock, E. B., Ottawa, Ont.
Harris, O. M., Montreal.
Hammond, James B., Sudbury, Ont.
Hanson, E., Montreal.
Hooper, William B., Rambroyn, N. Y.
Higginson, T. S., Buckingham.
Hegeler, J. W., La Salle, Ill.
Hayes, C. Willard, Washington.
Hardman, J. E., Oldham, N. S.
Hopper, R. T., Montreal.
Halsey, F. A., Sherbrooke.
Halsey, Mrs. F. A., Sherbrooke.

Irvine, Hon. Geo., Q. C., Johnson's Co., Quebec.
Irwin, W. H., Anglo-Can. Asbestos Co., Montreal.
Inman, A. L., Pittsburgh, Pa.
Inman, Wm. John, Plattsburgh, N. Y.

Jeffrey, W. H., Danville Asbestos Mines, Danville, Que.
Jones, John P., Iron Mountain, Mich.
Jones, Miss, Iron Mountain, Mich.
Johnson, C. S., Iron Mountain, Mich.
Johnson, Hon. Cecil, Harkness Hall, Scarboro', England.

Kirkwood, T. M., Sudbury.
Klein, L. A., American Asbestos Co., Black Lake Que.
Kirchhoff, C., New York.
Kirchhoff, Miss Lindon, New York.
Kennedy, John S., New Glasgow Coal and Iron Co., Ferrona, N. S.

Leckie, R. G., Londonderry, N. S.
Leckie, Mrs. R. G., Londonderry, N. S.
Leckie, R. G. E., Torbrook, N. S.
Lyman, Frank, Brooklyn, N. Y.
Lennon, G. H., Sudbury.
Lindsley, Stewart, Orange, N. J.
Lehman, Ambrose E., Philadilphia.
Lynch, W. H., Kootenay, B. C.
Leonard, Gardner C., Albany, N. Y.
Lidgey, Hubert, Murray Mine, Sudbury, Ont.
Lowe, A. P., Geological Survey, Ottawa.
Leofred, A., Quebec.
Laine, D., Levis, Quebec.

Moore, W. B., Pictou Charcoal Iron Co., New Glasgow, N. S.
Montague, Thomas, New York.
Mickle, G. R., Sudbury, Ont.
Moen, Philip, Worcester, Mass.
Morgan, C., Toronto.
Merritt, W. Hamilton, Toronto.
Medbury, Chas. F., Montreal.
MacIntosh, William, Buckingham.
Marcotte, J. A., Black Lake, Que.
Miller, J. B., Toronto.
Macdonald, Alex., St. Johns, Que.
McKay, John, Sault Ste Marie, Ont.
McConnell, Rinaldo, Mattawa, Ont.
McCormick, Henry, Harrisburg, Pa.
McCormick, Miss, Harrisburg, Pa.
McNaughton, James, Albany, N.Y.
McLennan, J. S., Dominion Coal Co., Boston.
McDougal George, Crescent Gold Co., Malone, Ont.
McEvoy, Jas., Geological Survey, Ottawa.
McDuff, George, Waverley, N.S.
McInnes, Wm., Geological Survey, Ottawa.
McRae, Hector, Electric Mining Co., Ottawa.
McGuiness, Miss, Dunnville, Pa.
McGee, Chas., Bristol Iron Co., Ottawa.
Nason, H. B., Troy, N.Y.
Nicol, Prof., Kingston, Ont.

Obalski, J., Inspector of Mines, Quebec.

Pardee, J. P., Stanhope, N.J.
Pardee, Mrs., Stanhope, N.J.
Phillips, W. B., Engineering and Mining Journal, N.Y.
Penhale, Matthew, Glasgow and Montreal Asbestos Co.,
Penhale, John J., United Asbestos Co., Black Lake, Que.
Black Lake, Que.
Proudfoot, F., Winnipeg,
Pullman, J. W., Philadelphia.
Pullman, Mrs., Philadelphia.
Poole, H. S., Acadia Coal Co., Stellarton, N.S.
Pinolet, L. M., New York.
Purves, James C. H., North Sydney, C.B.
Papineau, J. M., Montreal.
Peters, Richard, Jr., Philadelphia, Pa.

Raymond, Dr. R. W., New York.
Rossi, A. J., New York.
Richards, Robt. H., Boston.
Ramsay, W. M., Montreal.
Robb, D. W., Amherst, N.S.
Richardson, Prof. C. G., Toronto.
Rutherford, W., Toronto.
Russell, Walter S., Detroit, Mich.
Reid, Hon. James, Quesnelle, B.C.
Robert, J. A., Montreal.

Stevenson, A. W., Montreal.
Scaife, W. L., Pittsburgh.
Smith, Prof. T. Guilford, Buffalo.
Smith, Mrs. T. G., Buffalo.
See, Horace, New York.
See, Mrs. Horace, New York.
Smith, George R., Bell's Asbestos Co., Thetford, Que.
Selwyn, Dr. A. R. C., Geological Survey, Ottawa.
Speague, T. W., Boston.
Smock, J. C., Newton, N.J.
Smock, Mrs. J. C., Newton, N.J.
Smaill, Wm., Londonderry Iron Co., Londonderry, N.S.
Smith, J. Burley, British Phosphate Co., Glen Almond, Que.
Scott, George S., New York.
Sjostedt, E., Pictou Charcoal Iron Co., Bridgeville, N.S.
Spotswood, Geo. A., Kingston.
Struthers, W. D., Sudbury.
Swenzel, Miss, Scranton, Pa.

Taylor, Francis D., Montreal.
Torrey, H. C., New York.
Torrey, Mrs., New York.
Torrey, J. Gray, New Jersey.
Taylor, C. H., Montreal.
Taylor, Chas., Montreal.
Totdt, E. B., Albany, N.Y.
Totdt, Mrs. E. B., Albany, N.Y.
Tratman, E. E., Russell.
Tyrell, J. B., Geological Survey, Ottawa.

Viele, Mrs. M. J., Plattsburgh, N.Y.

Watson, Thos., Montreal.
Winchell, Horace, Minneapolis.

Wiley, W. H., New York.
Williams, H. J., Beaver Asbestos Co., Thetford.
Williams, Capt. John, New Rockland, Que.
Wellman, S. T., Thurlow, Pa.
Wellman, Mrs. S. T., Thurlow, Pa.
Wylde, H. M., Halifax.
Woodhouse, Alfred, Nova Scotia Gold Mines, Ltd., Halifax.
Woodworth, G. L., Belmont Iron Co., Marmora.
Wills, Mrs. J. Lainson, Ottawa.
Williams, H. H., Quebec.
Witterbee, F. S., Port Henry.
Williams, Oliver, Catasauqua, Pa.
Williams, Mrs. O., Catasauqua, Pa.

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### Reception in the Windsor Hall.

Shortly after eight o'clock the Hon. George Irvine, Q.C., President of the General Mining Association of Quebec, accompanied by His Worship Mayor Desjardins, took the platform. There were seated around him Mr. John Birkinbine, Philadelphia, President, and Dr. R. W. Raymond, Secretary, of the Institute; Mr. A. Blue, Director of Mines for the Province of Ontario, Toronto; Mr. F. Barnard, M.P., Victoria, B.C.; Mr. Macdougall, M.P., Sydney, C.B., Mr. J. Obalski, Inspector of Mines for the Province of Quebec; Capt. Robt. C. Adams, Vice-President General Mining Association of Quebec, Montreal; Messrs. W. H. Irwin and R. T. Hopper, Anglo-Canadian Asbestos Company, Montreal; Mr. A. W. Stevenson, Treasurer, and Mr. B. T. A. Bell, Secretary, General Mining Association of Quebec, and others. Altogether the attendance numbered about six hundred. There was a goodly attendance of ladies, many of them in evening dress, and the conventional dress suit was as prevalent and as acceptable as buds on a maple tree in April. The proceedings were enlivened by an excellent selection of music, given by the full band of the 1st Victoria Rifles.

HON. GEORGE IRVINE.—Ladies and gentlemen: In connection with my duty as president of the General Mining Association of the Province of Quebec, to preside at this meeting, you will be glad and relieved to know that it is not part of that duty to make a speech. I have, however, the pleasure of being able to tell you that there are other gentlemen here who will give you much more sound talk and eloquence than I could offer. I regret very much to say that several prominent men, whom we expected would take part in this evening's programme, have for one reason or another been prevented from attending. His Excellency the Governor-General, who was to have spoken at this convention, was unable, for reasons which he has explained to Mr. Bell, our Secretary, to come. The Lieutenant-Governor of Quebec, I am sorry to say on his own account and yours, is confined to his house through illness. It might be well perhaps to read to you telegrams and letters of regret which have been received from the several gentlemen who were to have been with us, but were prevented. (President Irvine read telegrams and letters of apology from His Excellency, Lord Stanley, His Honor the Lieutenant-Governor of Quebec, the Hon. T. Mayne Daly, Minister of the Interior, and the Hon. E. J. Flynn, Commissioner of Crown Lands, Quebec.)

We have therefore to forego the pleasure of listening to these gentlemen. I have on behalf of the General Mining Association of the Province of Quebec to welcome in the most cordial manner the mining engineers and their ladies and friends from the United States and Canada who have come here to attend this Convention; and particularly the ladies, who have already I hear, softened by their loveliness and graciousness the heart of old King Fost himself. We hope that by our best endeavors you may be enabled to enjoy to a full extent your visit. We feel a desire to do this more particularly because of the fact that when our people have visited the United States they have invariably been received with the greatest cordiality, kindness and hospitality; and we would like to show them that that kindness has been appreciated. I have now much pleasure in calling upon his Worship the Mayor to address you.

MAYOR DESJARDINS.—Ladies and gentlemen: We have just heard the letters of regret read which have been received from the distinguished gentlemen who were to have been here; and I am sure that deplorable fact has given you much disappointment. The fact that I am called upon to replace in part such well known orators proves that you are to be still further disappointed. I must tell you that when Mr. Bell, the Secretary of the Convention, invited me a few days ago to attend this opening, I felt he was paying me a great honor, but while I accepted, I did not know that it would be in the capacity of Mayor of Montreal that I would serve. For we in Montreal during the last few weeks have been in what I may call a condition of doubt. No one knew who was mayor. One day you would hear somebody say: "I am the mayor;" and the next day another voice would make a like assertion, and with equal confidence. And I myself, although I claimed also to be the mayor, was not altogether certain of the truth of the matter. However, I am here to-night, and I *am* the mayor.

And as such, ladies and gentlemen, allow me to say that we, the people of Montreal, are highly gratified at the choice which you have made in selecting this city of ours as the seat of the meetings of this great Convention. We welcome you cordially, and we hope that your stay with us will be pleasant, and that the people will show such interest in the labors which you are about to undertake, that you will carry home with you the most agreeable recollections of your sojourn among us. You will forgive, I am sure, the lamentable fact that the snow has prevented, by blocking the trains, so many of your delegates from being in time to attend here this evening; although they will have been spared the bad English of the Mayor of Montreal.

You will allow me, ladies and gentlemen, to first acquit myself of a certain duty, a pleasurable one, which is to first welcome the members of that veteran Institute of the American Mining Engineers which has for the last 64 years been at work with so much fidelity and zeal, and has accomplished so much for the advancement of the science of mining. We desire to say to them that whatever may be the discord between the two countries, it shall never destroy for our part the good fellowship and social intercourse existing between us. Nothing shall destroy that brotherhood of literary, scientific and intelligent amity.

To the divers associations which have been created within the past few years in the different provinces of the Dominion, we extend with equal warmth a most cordial welcome. They have a large field before them. We have only at the beginning to realize the amount of wealth and resources that good Mother Nature has in store for us. We have only at the beginning to realize, and it can be seen with half an eye, what can be achieved if these resources are properly worked. But that field we know is in good hands. We know that we have active, scientific men who will do all they can, and are doing all they can, to teach Canadians how to work these resources; and such good examples have been given us by our neighbors, that I am sure we shall soon be able to follow in their footsteps.

**H. S. Poole, M.A., F.G.S., Stellarton, President Mining Society of Nova Scotia.**

The questions you will have to study, the lectures you will hear, will not leave much room, by the practical essence of their very nature, for the imagination's play nor the inspirations of poetry. But you are practical men, and you will know how to supplement the deficiency. You have brought with you poetry—not in books, but far better than that—in reality; the poetry of heaven and nature combined! And we welcome that element, that refining and inspiring element, that foundation of what is best in poetry, with—shall I say, even more cordiality and tenderness than we welcome you of the *steely* sex.

I trust sincerely that the ladies may thoroughly enjoy their visit. They have heard, doubtless, of the attractions of our winter; and no doubt they have already since their arrival experienced in a practical manner one of those attractions—the sting of Jack Frost. For Jack Frost is a true Canadian in the sense that he has a fine appreciation, after his own fashion, of what is lovely and charming and tender. However, though our climate is cold, we shall endeavor to show you that it has not the slightest effect upon our hearts, naturally warm; for they are not cold. We welcome you all; and we trust that when such another Convention is contemplated, the members may be able to look back upon this one, and say: Why should we not go to Montreal?"

Mr. John Birklnbine, President of the American Institute of Mining Engineers, on being called upon by the Chairman to speak, begged to be excused in favor of Dr. Raymond, the Secretary of the American Institute, as he, Mr. Birkinbine, was down to deliver an address later on in the evening. Dr. Raymond, he said, usually spoke for the Institute on these occasions, and had a speech, he knew off by heart.

DR. RAYMOND.—There is one part of my speech, Mr. Chairman, ladies and gentlemen, which I did not learn by heart; and that is to say that though there have been 64 meetings of the Institute, the latter is not, as the Mayor supposed, 64 years old. We should certainly grow old very fast in that way. I have been present at 61 meetings, and I cannot count the number of times I have been an officer of some sort in connection with the Institute. It is also my duty to explain that the Institute is not a body having any local habitation whatever; for when we come to meet in Montreal, we do not come as a body of strangers; for the word "American," as applied to our societies, includes alike Canadians and those of us of the United States. Therefore, in coming to Montreal, we simply come, as it were, to our own. And, so from the beginning we have known nothing at all about latitude, nor of that thing we hear so much about—the boundary line. I may be treading on delicate ground when I say "Boundary Line." But, after all, where angels have rushed in, I should not fear to tread. The Mayor of Montreal has hit what I consider to be the truth in this connection, and in all connections where we from both sides of the line come together. So as I have no political ambitions on either side of the line, I may be permitted to say a word or two.

I am going to say in the first place that I do not think that pleasant and agreeable neighbors must necessarily marry. If I had to marry everybody that I ardently admire, there would be an awful breaking up of domestic ties in the families of members of the Institute of Mining Engineers. I think people can live humanely and affectionately side by side without thinking always about pulling down the partition. If Uncle Sam had to marry, I should prefer to see him join hands with a rosy, pink and frost-cheeked girl of the north rather than a dusky maiden of the Pacific; but it seems to me that if the United States and Canada were to become one, we—that is the United States—would then have as our nearest neighbor the North Pole; and I think that Canada would be a far more pleasant neighbor. Not that we should not consider all the domestic and internal questions of the future, as well as of the past. But, while speaking frankly, I may say that to me there is a higher view than this to take. For I for one would not tread upon those glorious distinctions which have enriched the past, and given us so many splendid memories. Standing upon this soil of Canada, I cannot forget the Lillies of France; nor can I forget what my countrymen owe to the sturdy Englishmen who crossed the sea, and won for us that liberty which we have always enjoyed at home. The Lillies of France, the Eagle of the Republic, the Cross of St. George, are all essential component parts of the historical, martial and national memories of America. And for my part I care very little—nay, I may say more—I pray to God that the meteor flag of England and the ensign of my country, whose stars bid welcome to the sunrise, may never stand opposed upon any battle field—nay, may never wave over any field of blood; but rather may blend and wax glorious together as the white and more glorious banner of peace and progress, and so set an example to the world. And in that splendid relationship we can move forward with serried ranks to a victory, unstained, irrevocable, magnificent, matchless; a victory that shall be celebrated by the glad thanksgivings of earth and blessed by the smile of a favoring heaven.

Dr. Raymond's excellent speech, it is hardly necessary to say, was listened to with absorbing interest, and loudly applauded at its termination.

The President then followed with an address on the "Development of Technical Societies."

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### The Development of Technical Societies.

MR. JOHN BIRKINBINE.—Through the partiality of my fellow members, I have been able during seven years service on the Council of the American Institute of Mining Engineers, to note the development of technical societies, a subject which commends itself as an appropriate theme for presentation at the time when relinquishing the office of president, we meet in convention with Canadian technical societies. Our next assembly, called at Chicago, at the time fixed for an International Engineering Congress, offers additional reasons for the selection of the topic.

If subsequent statements appear to give to the American Institute of Mining Engineers greater prominence than other kindred organizations, they may be excused upon the ground of long association with and loyalty to its members, and to a personal knowledge of their work. Besides, data as to growth and development is more accessable, and at a meeting of the Institute, features connected with it may be considered as of greater immediate interest than those affecting other organizations.

The purpose of this address is, however, to use the records of the Institute, as indicating a similar develop-

# International Mining Convention.

Hon. George Irvine, Q.C., Quebec, President, Genl. Mining Assn.

B. T. A. Bell, Ottawa, Secretary, Genl. Mining Assn.

Dr. R. W. Raymond, New York, Secretary, American Inst. of Mining Engineers.

A. W. Stevenson, C.A., Montreal, Treasurer, Genl. Mining Assn.

Capt. R. C. Adams, Montreal, Chairman, United Convention.

ment of other technical societies, rather than to claim pre-eminence for any organization; the work of each must speak for it.

Before referring especially to technical societies, a few thoughts may be devoted to the general tendency to form associations at the present time. Organizations may have been formed and are active in every profession and also in all branches of labor, trade, industry, commerce, manufacture, science and art. A record giving a list of such associations or the aggregate membership would be startling, and show how a large percentage of the population of North America is connected with one or more of these, but the figures cannot be even approximated.

The class of associations representing national, state or local trade interests, such as Boards of Trade, Chambers of Commerce, etc., may be used as an illustration. A late report showing that in the United States, there are over 1,100 of these, of which thirty are of national character, and more represent the interest of a State, or of districts including portions of a group of States.

Existing organizations may be divided into many classes, some of which are for mutual benefit in controlling rates, hours or character of labor, or for adjusting compensation paid or received for labor and materials. Others provide stipends for members during sickness or for their families in case of death, and another group seek to control the services of persons entering certain lines of employment, or fix standards for determining the qualifications of such. The proceedings of many associations are carried on in secret, others are more or less open, some use extreme scrutiny as to membership, and others may be included in the class, "omnium gatherum."

In all these forms of organizations, there is some good; any union for mutual advancement commands esteem, but in a number of cases, the better element of the membership is hidden or over-ruled by selfish purposes controlling the administration of affairs to the disadvantage of the mutual or progressive features. Probably no better evidence can be offered of the power of a few men to control others, or of the blind obedience of the masses to arbitrary dictation by leaders, than is presented by some of the popular trade organizations.

The class, however, in which we are especially interested includes those institutes or societies where professional and business men, recognizing the value of the interchange of ideas, assemble to discuss problems and processes, and while no comparison of the relative merits of various forms of organizations will be made, it may not seem ungenerous or exhibit vanity, to claim for those whose primary objects are the investigation and discussion of subjects in which the members are interested, and the publication of the proceedings or transactions for the general advancement of a special trade or profession, as being in the foremost class of associations.

The number of different societies which may be properly in the special class mentioned, is greater than is generally believed; for, if from the list of all kinds of associations, there were eliminated the social or secret organizations, all others, which in any way attempt to affect or control the rates of wages or the hours or kinds of labor, or to fix or adjust prices for commodities, all strictly commercial organizations, and all those which offer any money benefit to members or their representatives, or those formed to advance certain sects, parties, nationalities, or classes, there will still be found a considerable number of organizations representing constituencies of many thousands joined together for the purpose of mutual advancement and for improving special professions or businesses in which the members are engaged, by the interchange of ideas, and dissemination of thoughtful papers and discussions.

Diversified business or professional interests encourage a considerable number of persons taking part in several associations, more or less closely allied, thus forming many powerful organizations of manufacturers engaged in special lines, and also of men following various professions. Thus, the legal fraternity presents a liberal contingent of associations representing that branch of professional work. Officers and members of various churches are formed into clubs, independent of synods, classes, assemblies, etc., and geologists, chemists, journalists, architects, artists, and engineers each have special organizations. It is to the last named group that attention is particularly invited.

Nearly twenty-two years have elapsed since the American Institute of Mining Engineers was organized, and its score of original membership has increased, the rolls now containing nearly 2,400 names while the necrological data preserved in our records calls attention to the fact that over two hundred late members of the Institute have finished their earthly work and gone to their reward. In this list of the departed, are names of men who have done valiant service in the interests of mining and metallurgy, whose work lives and will live, and whose record is familiar, not only in their own, but in foreign countries.

Prior to to the organization of the Institute, there was in the United States, but one national engineering society, and but few local organizations devoted to this profession, while the list of organizations in foreign countries was small. There are to-day in the United States, four engineering societies of national character, with memberships as follows:—

American Society of Civil Engineers, organized 1865, membership of 1,650.

American Institute of Mining Engineers, organized 1871, membership 2,400.

American Society Mechanical Engineers, organized 1880, membership 1,650.

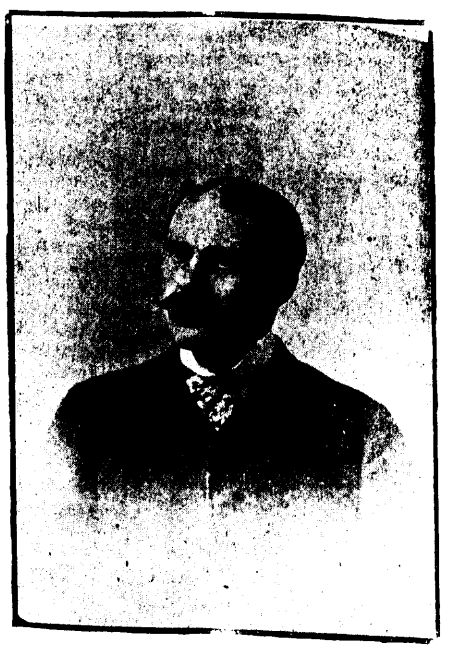
American Institute Electrical Engineers, organized 1886, membership 650.

The scopes of these national associations vary to suit the purpose of organization, and the policy pursued in each differs from that of the others, being presumably adapted for the membership, which has in each extended beyond the limits of the United States, embracing many of the prominent engineers in Canada, Mexico, and in foreign countries.

Therefore, the engineering profession in the United States is well equipped with national associations, in which those interested in any particular branch, or who desire to follow a special line of inquiry, meet with others having similar purposes for the reading of papers, or for the discussion of topics in which they are mutually interested; or if prevented from attending meetings, members can peruse the transactions as issued, from which information as to what has been presented and discussed is obtainable.

There are also national associations closely allied to engineering, which have obtained prominence and rendered much service to the members, or to the business represented, as well as to engineering; at the meetings of which papers are presented and discussed and publication made of matters of interest. Among such, are the associations of master mechanics, of railroad superintendents, car-wheel makers, car builders, founders, boiler makers and others.

To the national associations are to be added a score of local or district engineering societies or clubs, some of which have 500 names on the roll of members, possess excellent libraries, issue proceedings regularly and occupy commodious quarters in which the social intercourse of engineers is encouraged, as an incentive to professional advancement.



**W. Hamilton Merritt, A.R.S.M., Toronto, Chairman, Ontario Committee.**

The present meeting indicates that the Dominion is alive to the necessity of technical societies, for the Canadian Society of Civil Engineers, both by its membership (of 700) and its record is given a prominent place among engineering organizations, and the opportunity is cordially embraced of meeting with and learning of the General Mining Association of Quebec, the Mining Society of Nova Scotia, the Asbestos Club, and all other Canadian societies, who now meet in convention with the American Institute of Mining Engineers.

It is unnecessary to trace the history of foreign associations of engineers, beginning with the social club claimed to have been organized by Smeaton about 1771, nor to mention the number of associations devoted to engineering or kindred sciences, as given in the "Official Year Book of the Scientific and Learned Societies of Great Britain and Ireland." But in view of the courtesies which in late years have been exchanged between European and American engineers, the active interest in technical organizations in Europe will be recognized by reference to a few of the most powerful and well known societies.

The Institute of Civil Engineers of Great Britain reports a total of all classes of members exceeding 6,000.

The Societé des Ingénieurs Civils, France, has over 1300 members.

The organization of Civil Engineers in the German Empire reports some 6,000 members on its roll, and the Mechanical Engineers have an association of about the same size.

The Iron and Steel Institute of Great Britain number 1,500.

The Verein Deutcher Eisenheutenleute has over 1,000 members. In addition there are societies in Russia, Sweden, Australia and, to us, other remote parts of the world.

It is expected that delegates from most of these associations will take part in the Engineering Congress at Chicago, in August next; an occasion which should do much to advance the fraternal feeling and the professional interests throughout the world.

The numerous technical and semi-technical societies mentioned, have not grown nor are they sustained merely by the social features they offer, pleasant as these may be; their formation was encouraged by a desire to interchange ideas, and they are maintained because of the benefit to be derived from the papers presented and discussed.

A past president of the British Iron and Steel Institute refers to the visit of that organization to the United States in 1890, with sentiments which may properly be employed to express the purpose and results of meetings which various associations have held and will hold in different portions of the world, and which may certainly be quoted on the present occasion:

"These expeditions, through which we meet eye to eye, and voice to voice, our friendly competitors, to discuss the interests and the scientific aspects of the industry which absorb us, have been of great personal and national benefit. It is thus we learn how much has been accomplished by persistent and intelligent labour, how much remains to be achieved, and how by free exchange of ideas and of productions, friendly understanding is promoted and personal acquaintance is built up."

Those who have followed the growth of the American Institute of Mining Engineers, recognize its work in the contents of its transactions, but trace its influence, and that of kindred associations, in the advanced work in laboratories and engineering offices, in the growing appreciation of technical education, in improved methods of mining and metallurgy, and in a better understanding of geology, chemistry and other sciences.

Similarly much of the progress in applied science is directly traceable to other technical societies, and every branch of industry shows the good result of co-operation by those interested in special investigations.

In reviewing the history of the institute, it will be profitable to note the advances made in some special branches in which its members are directly interested; for the years covered by its life have been marked by great progress in the quantities of mineral won, metal produced and manufactured, and of a very great decline in the prices which the products of mine, furnace or factory command. Ample allowance may be made for the demands of a rapidly augmenting population, or for Governmental encouragement of industry, and yet the claim that a great part of this progress, both as represented by the increased production and decreased cost, is due to the development of technical societies, must be recognized. It is certain that in a number of known cases, men have been better equipped and better able to contend with the problems before them, because of their connection with technical societies, bringing to them the papers read and discussions had thereon, and much is undoubtedly due to close personal acquaintance and friendship resulting from association. A few facts selected from many which could be mentioned illustrate the progress made during the existence of the American Institute of Mining Engineers 1871-1893, and while the data presented refers to the United States, similar results, although possibly less pronounced in some cases, could be obtained for other countries.

The annual output of iron ore has increased from three millions to over sixteen million gross tons, making the United States the largest producer of this mineral, while for the past decade nearly a million tons of foreign iron ore per year found a market in the country. When the Institute was organized the Lake Superior iron district was producing slightly over eight hundred thousand tons of iron ore per annum and had up to that time shipped an aggregate of four million tons; it has now reached an annual output of over nine million tons, and in the twenty-two years existence of the Institute, it has furnished a total of seventy million gross tons. One and two-third million gross tons of pig iron (a) was the output of the blast furnaces of the United States, at the birth of the Institute, last year shows a total of over nine million gross tons (b).

New districts have been opened, and sections which supported iron industries of but small capacity, have grown to be large producers. In the early days of this society, the pig iron output was obtained from a number of small furnaces, and about one half was made with anthracite coal, three tenths with bituminous coal and coke, and one fifth with charcoal. Now three-quarters of the pig iron is produced with coke, the balance being divided into about the same proportion as in 1871, between anthracite and charcoal, but the quantities of each has been greatly increased, and owing to improved construction and methods, a smaller number of furnaces produce the larger quantity of pig iron.

The steel industry has, in twenty-two years developed from an annual output of seventy thousand gross tons to one of four million gross tons (a). When the first meeting of the Institute was held, the Bessemer steel industry was making its initial impression on this continent, while open hearth steel manufacture was a struggling infant. The former has advanced from an annual output of thirty-five tons to one exceeding four million tons (b) and while the latter has grown from three thousand tons to nearly six hundred thousand tons per annum (c).

In an interesting monograph, entitled "Twenty Years of Progress in the Manufacture of Iron and Steel in the United States," Mr. James M. Swank says (d): "It

(a) 28 per cent of what Great Britain then produced.
(b) A product of pig iron 20 per cent. greater than that of Great Britain in the same year.
(a) Bringing the United States in advance of the magnificent industry of Great Britain.
(b) A product nearly double that of Great Britain.
(c) This quantity is less than one half of the amount of open hearth steel made in Great Britain.
(d) Mineral resources of the United States 1891.

seems almost incredible that as late as 1860 this country should have produced only 11,838 tons of all kinds of steel; yet these are the official government statistics. Our magnificent steel industry is virtually therefor the creation of the present generation." And yet with all these advances in the steel industry, with the displacement of iron rails by steel rails, the rolling of iron in all shapes has increased.

This inquiry might be carried further into the manufacture of rails, plate and bar iron and steel, nails, the construction of metal bridges, ships, locomotives, cars, machinery and the great works filled with superb appliances for fabricating them. But this is not the place for details, and further reference to the production of iron or steel will be confined to the statement that a ton of pig iron, of bar or plate iron, or a keg of nails, now sells at from 33 to 40 per cent. of what was received for it in 1871, while the price of steel rails is but 25 per cent. of what these commanded at the date mentioned.

In 1871 the greatest depth which had been reached in any of the copper mines of the Lake Superior region approximated 1,000 feet, and the price per pound for copper was thirty cents and upwards. It was then impracticable to work any of these mines which did not produce a mineral carrying 2 per cent. or more of copper. At the present time in that district, mines are 4,000 feet deep, and although copper sells for twelve cents per pound, mineral yielding six-tenths of one per cent. of copper is raised from a depth of 2,000 feet, crushed, jigged, delivered at refining works and sold at a moderate profit on the operation.

In the interval, the magnificent copper deposits of Montana and Arizona have been developed, the former taking first place as a producer, with the Lake Superior region second, and the total production of the United States of three hundred million pounds of copper, is now five times what it was in 1871. In addition the important discoveries and exploration of the copper and nickel deposits in the Sudbury district of Ontario, Canada, which have justly attracted widespread attention, deserve notice as factors materially influencing the output of copper.

The life of the Institute has seen the development of the heroic method of working gold gravels by hydraulic mining and also its decline, owing to legislation prohibiting tailing into the streams of California, which reduced the output of the gold some $10,000,000 per year. Although the hydraulic system was used in 1852, it was not until 1870 that the first large "inverted siphon" was introduced in the gold gravel section of California, and in 1876, the "deflector" was added to facilitate the handling of the "little giants." Under favorable conditions gold gravel has been treated by the hydraulic system for three cents per cubic yard.

In the treatment of gold ores by chlorination, advance has been made both in reducing the cost and working to a close extraction. Barrel chlorination has supplemented vat chlorination, late cost sheets showing favorable results.

The liberal introduction of vanners, and the consequent saving of the pyrites, which nearly always exist, may be cited as another important change.

Pan amalgamation for silver ore has improved and cheapened and silver lixiviation has made important advances, while silver lead smelting has been greatly developed. In 1871 there were few smelting plants west of the Mississippi River. Now magnificent smelting plants are operated at Denver, Pueblo, Omaha, Salt Lake City, Leadville and elsewhere.

The so-called "practical" smelter has given way before the chemist and the experienced lead metallurgist. Cleaner and better work is now done, lower grade lead ores are utilized than formerly and lead slags made in 1878 are now being re-worked.

Direct matte smelting is another innovation, and while much has been done in concentration, this held is still very promising. In the time under discussion, the annual output of silver in the United States increased in value from $16,000,000 to $75,000,000.

In a former address attention was drawn to the growth of the coal industry, it is only necessary therefore to refer to the distribution and the production of mineral fuel, increasing five-fold since 1871 and reaching an annual total of one hundred and fifty million tons, of which practically one-third is anthracite, and two-thirds bituminous, while in 1871 nearly equal portions of the two kinds of fuel were mined.

In the interval of time covered by the records of the Institute, power drills and high explosives have become necessities of mining, electricity has risen from a laboratory experiment, or a medium for operating telegraph lines to universal usefulness for light, and in many cases for power, and aluminum has entered the list of practically useful metals.

The above is a glimpse we obtain by looking backward, and if as has been claimed, much of this progress mentioned may be properly credited to the influence of technical societies, a glance forward may be permissable, for the end is not yet, and further increase in the number, membership, and importance of technical associations, may be expected.

Each society will in generous rivalry employ the best for securing the highest results to be derived from organization. In view of the past and recognizing that but a small proportion of those connected with any technical society can attend its meetings, the line of advance seems to be in the direction of maintaining a high standard for the transactions.

The purpose of meeting together is but partially fulfilled by the pleasures of personal intercourse, by warm welcomes and generous entertainment, by visits under advantageous conditions to industries or mines, and by the reading of papers; for there is much profit in full discussion of many of the topics presented.

The discussions which should follow the presentation of most papers, make the contributions more valuable, and as a rule bring out information which the original does not contain. The papers are thus made more useful, not only by reason of these additions, but also because discussions upon the statements of the writers give to these greater weight. If statements are unchallenged in such discussions, the conclusions ordinarily reached would be that the premises upon which they were based are sound. On the other hand, discussions which might probably appear to challenge the data presented in papers do not, necessarily, condemn them, but may cause them to be so modified as to be of greater value than as originally presented.

There may be either the oral or written discussion. Some organizations follow the practice of printing papers in full prior to the meetings, and reading the papers in abstract, making the discussions the prominent features. Others have papers read in extenso, followed by oral debate but the discussions are often less complete than is desired. The time allotted to sessions seldom permits of reading long papers, and allowing unlimited hours to the discussion, but in many contributions presented there are some features which need not, and others which should not be read in the sessions, as these would be tiresome if read in detail. Analyses, tables, statistics, etc., placed upon black boards, issued in proof form, or exhibited by a diagram or by lantern slide permit listeners to grasp them more readily and considerable time is saved.

A fair proportion of the papers presented before technical societies, are not such as to invite debate, but those offering points for discussion should be discussed, and if members who attend the meetings are prepared to respond promptly, confining the discussions within limited time and closely following the scheme of the papers, a large amount of valuable information can be imparted. The character and extent of discussions lies not with the officers of the organization, but with the members and the subsequent value of the publication is likewise dependent upon the promptness and care which characterizes the revision of the subject matter, by individuals who participated.

A. Blue, Toronto, Director of Mines for Ontario.

Believing that future advances in technical societies will be influenced by the publication of well digested monographs, and by liberal encouragement of discussions upon the papers read, it seems to be better policy to print a small number of papers fully discussed, than to merely issue a large amount of material offering controversial data without discussion.

Oral discussions offer the advantage of being more attractive and interesting to those attending meetings than the written discussion. the latter is generally more carefully prepared than the extemporaneous statements made when the members are in convention, but there are points often omitted in written discussion which would be brought out under the spur of personal contact, and members are less likely to take part in the written than in oral discussions.

The late Hon. James G. Blaine, writing on the growth of reports of Congressional debates, makes some interesting statements, and while these are quoted, the intention is not to intimate any close analogy between the Congressional debates and the business of the technical discussions which enliven the meetings of the organizations specified, but rather to advocate initial oral discussion, supplemented by written data.

Mr. Blaine says:

"In the beginning of the Government, and for many years thereafter, on every important measure that came before Congress of the United States, on the expediency of which the members differed in opinion, there was an actual debate, in which positions were affirmed and contested with oft-hand speech. In every conflict of this kind the member of Congress were, as a rule, in their seats, many taking part, and the mass so interested as to sit continuously through the debates." After illustrating how the habit of speech has greatly changed and the general use of manuscript discussions read to many vacant chairs, extending in one house of Congress to giving permission to print speeches not one word of which has been delivered, Mr. Blaine mentions the Fiftieth Congress, which lasted from March 4th, 1887, to March 4th, 1889, and says:

"In an uneventful period, with nothing specially to excite or disturb the country, the number of pages filled by the proceedings of a single Congress is greater than during the whole period of the Civil war, with all its mighty issues at stake."

To make a comprehensive and most suggestive comparison, he states that "the Congressional reports for the last twenty-five years contained in volume of printed matter, 60 per cent. more than all the reports for the seventy-six years from the inauguration of Washington in 1789 to the close of the Civil War in 1865."

It may be unfair to compare political debates and technical discussions, and the above is not introduced with any such object. The extracts are merely quoted to indicate the interest which attaches to oral discussion drawing to the meetings members anxious to hear or to participate, and eliciting a variety of opinions which would not be obtained under other circumstances. Such interest once excited may draw into the discussion persons who are not present, and thus gain the advantage of subsequent written discussions.

The papers presented at the meetings of technical societies and the discussions on these papers supply a record of progress, such as would be impracticable to obtain from any other source, and place in the libraries of members a fund of knowledge, which otherwise could only be secured by liberal personal outlays for expensive books. Without in any way detracting from the value and importance of works issued upon technical subjects, it may be safely asserted that it is impossible for special treatises to be as closely up to the times, as the transactions of technical societies, and thus each member of the various organizations can have an encyclopedia library as part compensation for his outlay in support of the society.

Another important influence exerted by papers and discussions is in the publicity given these by the trade and technical press. It has been claimed that members of engineering associations devote their energies to papers to be read before the technical societies which otherwise would be contributed directly to the technical press, but it is questionable whether in this particular the press at large is not the gainer, although possibly a limited number may lose special contributors; for the incentive to submit papers for the criticism of fellow members increases the number of available contributors, and educates many to write for publication who would otherwise be silent.

My effort has been made to show the remarkable development of technical societies, giving some reasons therefor, and the claim has been made, which seems to be within reason, that the broader sentiment which has caused engineers to unite in associations, is responsible for a good share of the industrial advance which has been made. The thoughts as to the future increase and the most advantageous means of obtaining from these associations the full value which they offer, may be open to criticism, but they are presented after a careful review of the work of numerous engineering societies, backed by a personal knowledge of some most important results which have followed the presentation and the active discussion of papers presented.

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At the conclusion of Mr. Birkinbine's address the visiting delegates were presented to His Worship the Mayor and Madam Desjardins. Then the band played, and a large space was cleared in the centre of the hall, where the "muse of the many twinkling feet" was hailed the supreme goddess of the moment, and those who could not dance—where will you go that you do not find the man who does not dance?—looked on with envious eyes; for the music was positively, and the ladies superlatively sweet.

And after that, it may possibly be necessary to add, *all* the men went to bed; some to dream of the hard nuts to crack with the hammer of science upon the anvil of common-sense on the morrow, of the papers innumerable and the probable questions still more so; but all such dreamers more or less to have their scientific nightmares put to flight, and their sleep blessed by the vision of a face or the memory of a feminine figure drifting through the land of sleep to the air of a Strauss waltz.

## Proceedings of the Sixty-fourth Meeting of the American Institute of Mining Engineers

The opening Session took place on Wednesday morning, 22nd instant, in the Physics Building, McGill University, Mr. John Birkinbine, President, in the Chair. The following is a synopsis of the proceedings at this, and at the meetings held in the afternoon and on Thursday morning.

Dr. Raymond, the Secretary, read the report of the Council. The membership has had a net increase of 154 during the year, and the total is now 2,376, as follows:

| | |
|---|---|
| Honorary members | 15 |
| Foreign members | 38 |
| Members | 2,136 |
| Associates | 187 |
| Total | 2,376 |

The total receipts were $26,595, and disbursements $23,131, leaving a balance of $3,483. The Council, for the Institute, has accepted the charge of the two divisions of Mining and Metallurgy of the International Engineering Congress, which will be held the first week in August, at Chicago, and these will constitute regular meetings of the Institute.

The first paper presented was by Major Powell, on the "Geological Survey of the United States," which was read by Mr. Hayes. For a geological map there must be: 1, A base map on which to represent the rock formations, 2, a systematic classification of the formations; and, 3, a system of conventions for representing these formations on the map. One of the first things to be done was to arrive at a systematic classification of rocks, and scheme of representing them. The system adopted by the Geological Survey was described, with notes on the classification. Sections are of most value if printed on the body of the map instead of in the margin, but as this would complicate the colors and symbols, special sheets of sections, topography, surface deposits, etc, are issued. The maps are mainly on a scale of 1 inch to the mile, and are published as atlas sheets. About 12,000 square miles have been covered. The total cost, including engineering, is given as $4 per sq. mile for the topographic survey, and $7 to $8 per sq. mile for the geologic survey. Dr Selwyn, Director of the Geological Survey of Canada, referred to the work and systems in Great Britain and Canada, the latter being hampered by the very small amount of money available, only $60,000 as compared with $300,000 in the United States. It would be absurd, he thought, to attempt to imitate on maps the color of the rock formations, but he thought it desirable to have some more uniform representation. He also believed in the use of lines and letters as well as colors. Dr. Raymond agreed with Dr. Selwyn as to the desirability of a uniform system of representation, and he did not want the United States standing out obstinately for its own system. Dr. Day, of the U. S. Geological Survey, said the matter in hand had to be published, and they tried to use the best system available.

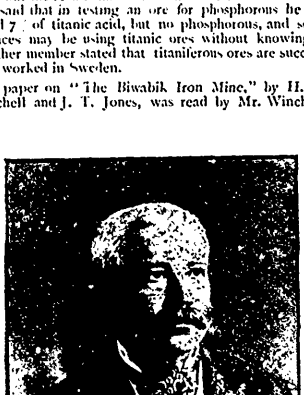
A paper on "The Greene-Wahl Process for manufacturing Manganese and Alloys of Manganese free from Carbon," was then read by Mr. F. Lynwood Garrison. Samples were exhibited having an average composition of 96·5 manganese, 2 iron and 1·5 silicon, the metal being dense and homogeneous, with a steel-gray color and red dish-bronze tint. It has a pungent odor, attributed to hydrogen silicide, has no tendency to oxidize and disintegrate in moist air, as does manganese containing considerable carbon, and it has an average specific gravity of 7·32. In the discourse, reference was made to an electric smelting furnace, and Dr. Raymond stated that the minimum cost of production of aluminum by any process now known would probably be 18 to 20 cts. He did not think the adoption of water-power would reduce this, as where coal is cheap the steam engine is still the cheapest form of power.

Prof. W. B. Blake then read abstracts of three papers, dealing with lead and zinc ores: "The Mineral Deposits of South-west Wisconsin," "Separation of Blende from Pyrites," and "A New Form of Furnace for Roasting and Oxidizing Ores." The furnace is a revolving table formed of a series of circular terraces, and is charged from the top, while the fire passes across the chamber. The ore is moved from step to step by means of "plows" set in the roof of the chamber, and by this method the ore is thoroughly subjected to the heat, and is nearer the fire just before its discharge. Superheated air is used in the furnace, and the table makes about ten revolutions per hour.

At the afternoon meeting Mr. R. H. Richards read a paper on the "Prismatic Stadia Telescope," being a continuation of a former paper, and giving details of the rods and targets, and also of a self-spacing target.

Mr. A. J. Rossi then read an abstract of a paper on "Titaniferous Ores in the Blast Furnace." These ores are generally low in phosphorous and sulphur, and many are very rich in iron, even when high in titanic acid. Particulars were given of numerous tests, showing that good pig iron can be successfully made, and that this ore may become more generally available. "We do not claim," said Mr. Rossi, "that everything has been settled definitely by this experiment. But it has been possible to obtain from ores containing some 20 per cent. of $TiO_2$, in continuous manner, under the conditions of working of a furnace and on a scale certainly unfavorable to good reduction of the ores and a proper distribution of heat in the different parts, both slags and pig-iron. The slags showed good fluidity and basicity, though containing some, 25 $TiO_2$ to 22 $SiO_2$; others 40 $TiO_2$ to 22 $SiO_2$, and some 35 $TiO_2$ to 14 $SiO_2$, with magnesia, alumina, and lime as bases. No other addition of fluxes to the ores and coke was required than limestone (dolomite and calcite mixed, pure lime having been once resorted to for want of calcite); and the consumption of materials (certainly of flux and even of coke, considering the dimensions of the furnace) was fairly economical for a 51 per cent. iron-ore, viz., ore 50, coke 50, stone 21. At the same time a mottled or mottled-white iron was obtained which was considered as very strong by some founders, and which we offer for examination." Prof. Harrington said that experiments had been made with Canadian ore containing 48% titanic acid, but the results had not been successful. Dr Egleston said that in testing an ore for phosphorous he had found 7% of titanic acid, but no phosphorous, and some furnaces may be using titanic ores without knowing it. Another member stated that titaniferous ores are successfully worked in Sweden.

A paper on "The Biwabik Iron Mine," by H. V. Winchell and J. T. Jones, was read by Mr. Winchell.



R. G. Leckie, Londonderry, N.S., Vice-President, American Inst. of Mining Engineers; Vice-Pres., M'ng Soc. of Nova Scotia.

This is one of the newest mines of the Mesaba Range, and while no ore has yet been shipped a considerable amount of money has been spent in thorough exploration. The working will be by stripping and open pit mining. There will be about 2,800,000 cubic yards of glacial drift removed to prepare the deposit for working, and the deposits are about half a mile wide and 100 ft. thick in places. The grades of the steam shovel tracks will be 1½. The ore is soft, and averages 63.25% metallic iron and .036 phosphorus. The steam shovels will dig the ore and load directly on to the cars. The stripping will be dumped by side dump cars. Dr. Raymond said that the topographic and other conditions are so good that probably the cost will be only about 16 cts. per ton for stripping, mining and loading. Mr. Birkinbine referred to the recent and rapid developments of these Minnesota iron deposits, and stated that the men who developed the Vermilion Range, passed over the Mesaba Range, which is now being developed.

At the morning meeting on Thursday, Feb. 23, Mr. R. H. Richards read a paper on "A Graphical Slag Calculation." This was followed by Mr. E. E. Russell Tratman, of New York, with a paper on the subject of

### Unfreezable Dynamite,

The use of dynamite in cold weather is attended with some difficulty, owing to the freezing of the material and its consequent liability to fail to explode when the fuse is fired. With proper methods and care the dynamite can be thawed with reasonable safety, but numerous accidents occur (more than get reported in the public press), due to carelessness in the operation and to the treacherous nature of the material, or a combination of both conditions. Dynamite will stand treatment at one time which at another will result in explosion. An expert on explosives says that the most dangerous means of thawing cartridges are ingeniously devised by ignorant laborers; baking, boiling and toasting being favorite methods, while at a stone quarry, in one instance, an apparatus was arranged for steaming cartridges over a pot of boiling water. In this latter case the nitro-glycerine leaked through the canvas cover and settled on the bottom of the pot, with the result that an explosion occurred, the water acting as a tamping to the charge.

The fact that small quantities of explosives containing nitro-glycerine will burn quietly and without explosion if ignited by direct contact with a flame, has led to the dangerously mistaken reasoning that merely heating the explosive can produce no ill effect. If a dynamite cartridge is ignited or placed in a fire it will probably burn harmlessly away, but if placed on a stove or in an oven, and gradually heated to its exploding temperature of 350 to 400 F., a violent explosion is almost certain to result, while before that point is reached the dynamite will become extremely sensitive to shock.

In England alone, from the beginning of 1872 to the beginning of 1890, there were reported 63 accidents due to improper thawing of dynamite, by which 50 lives were lost and 76 persons injured.

Reference may here be made to the explosion of dynamite, December 28th, 1892, in a thawing apparatus at the works for commencing the Brooklyn end of the proposed New York and Brooklyn tunnel, by which four persons were killed and about twenty injured. According to report, the thawing was done by placing the cartridges on shelves in a chamber six feet square and eight feet high, heated by a coil of steampipes.

An unfreezable dynamite invented by Liebert, a German, has been used to some extent in Europe, and has been favorably reported upon by chemists and experts in explosives, and it would appear most advisable to test its practical efficiency in this country. The dynamite is made in the usual way, but its composition includes a chemical (isoamylic nitrate), by which its freezing point is lowered from 40° above to 50° below F., while the explosive power is slightly increased and the sensitiveness to concussion slightly decreased. This dynamite, it is claimed, is not effected by damp; it may be kept for considerable time without deteriorating or losing its special properties, and its cost is little, if at all, in excess of that of ordinary dynamite. It is patented in the United States. It certainly seems that if there is a reliable dynamite, unfreezable, at very low temperatures, and procurable at reasonable cost, it should find a field for introduction in the United States and Canada, and that steps should be taken to insure its introduction, in the interests of life and property.

In the discussion several methods of thawing dynamite cartridges were referred to, but it was shown that they do not provide for carelessness on the part of the laborers who use them. Mr. J. T. Jones described an apparatus for thawing cartridges, consisting of a tin box with tubes, like a tubular boiler; the box is filled with water and heated by an ordinary lamp, and the cartridges are placed within the tubes. Mr. M. Penhale had utilized the exhaust steam of an engine for heating a chamber in which the cartridges were placed. Mr. W. B. Phillips did not believe that there was ground for believing that that seepage of the nitro-glycerine would occur in cartridges, and he had opened and ground up a number of cartridges without finding any evidence of such seepage. With Rock-a-Rock the oil and the cartridges are kept separate in winter until the latter are to be used.

Dr. R. W. Raymond said that rackarock has a strong odor which affects the men, and he had had to give up using it. He thought there was no doubt that seepage of the nitro-glycerine frequently occurs, and is a great source of danger in the use of dynamite. As this occurs largely when the cartridges are being thawed, an unfreezeable dynamite would greatly reduce the danger. As to thawing apparatus, while many safe arrangements may be devised, there is no guarantee that they will be carefully or properly used, as a careless laborer in a hurry to thaw out some cartridges, may disregard all precautions. Prof. W. P. Blake stated that in a case of his own experience the cartridges were placed on racks in a cabin, where they were thawed, but that an explosion occurred owing, it was supposed, to some of the boys sent to fetch cartridges finding them not ready for use and lighting a fire to hasten the thawing. Mr. Woodworth said that in a dynamite storage room one box was left standing on end, and the glycerine seeped out from the cartridges and saturated the wood. Mr. Tratman referred to the use of a double box, with manure packed in the surrounding space, for storing dynamite in cold weather, as used in the Croton Aqueduct. At the works of the Londonderry Iron Co. (Nova Scotia) a double box with mineral wool packing is used to store the thawed cartridges. Mr. J. F. Torrence said he had used the ordinary warming apparatus consisting of two tin boxes, one within the other, with hot water in the space between them, the cartridges being placed in the inner box, but he had found an oily film settle on the bottom of the box, being seepage from the cartridges. He thought many accidents were due to imperfect combination of the nitro-glycerine with the dope.

## Third Annual General Meeting of the General Mining Association of the Province of Quebec.

The third annual general meeting of the General Mining Association of the Province of Quebec was held in Lecture Room B., Physics Building, McGill University, on Wednesday, 22nd February. The Hon. George Irvine, Q. C., (Johnson's Company) Quebec, President, in the chair. After the presentation of the Treasurer's and Secretary's reports, which were unanimously accepted, the following officers and council were elected for the ensuing year: *President*: Hon. George Irvine, Q. C., (Johnson's Company) Quebec; *Vice-President*: Capt. R. C. Adams (Anglo-Canadian Phosphate) Co. Montreal; Mr. John Blue, Eustis Mining Co.) Capelton, Que; James King, M. L. A. (King Bros.) Quebec; R. T. Hopper, (Anglo-Canadian Asbestos Co.) Montreal. *Council*: L. A. Klein, (American Asbestos Co.) Black Lake, Que; J. Burley Smith, (British Phosphate Co.) Glen Almond, Que.; George E. Drummond, (Canada Iron Furnace) Montreal; F. P. Buck, (Dominion Lime and Marble Co.) Sherbrooke; His Honor Judge Dugas, Montreal; S. P. Franchot, (Emerald Mining Co.) Buckingham; W. H. Irwin, (Anglo-Canadian Asbestos Co.) Montreal; John J. Penhale, (United Asbestos Co.) Black Lake; Col. Lucke (Beaver Asbestos Co.) Sherbrooke. *Treasurer*: Mr. A. W. Stevenson, C. A. 17 St. John St., Montreal; *Secretary*: B. T. A. Bell, Editor CANADIAN MINING REVIEW, Ottawa. The meeting then adjourned until Friday 23rd inst.

## The Duty on Mining Machinery. A safe building for the housing of the Geological and Natural History Survey Museum an urgent necessity.

These were in the main the subjects for discussion at the adjourned meeting of the General Mining Association of the Province of Quebec which was held in the New Club Room, Windsor Hotel, Montreal, on Friday, 23rd February. There was a large attendence of members. Hon. George Irvine, Q. C. presided.

MR. B. T. A. BELL.—One of the resolutions left over from the united meeting yesterday was that relating to the customs tariff on mining machinery. As you know the Dominion Government with the object of encouraging the development of our mines amended the tariff in 1890 so as to admit all machinery for mining purposes of a class or kind not manufactured in the Dominion free of duty. The period was for three years and expires, I think, next month. The Government has again renewed this provision for a like period. The Act is in the main liberal, but difficulty seems to have been experienced in its interpretation at some of the ports of entry by the collectors. While in several districts no difficulty has been experienced in passing mining machinery in free of duty, at others the duty has been enforced on machinery which distinctly was not made in Canada. The collectors seemingly were not instructed what class and kind of machinery should come in duty free. It has been thought that some representations might be made to the Government on the subject.

CAPT. R. C. ADAMS.—This is one of the questions I desired to speak about. As it is the law is a perfect farce. I enquired, when in British Columbia, how it worked there and found that it created a great deal of bother. An importer brought in some piece of machinery which the collector often held for duty pending investigation, and then as likely as not some country blacksmith was found to claim that he could manufacture the machinery. I would like to see this association, now that tariff reform seems to be in order, make some expression of opinion on the subject and not be content that the paltry concessions given us be continued.

MR. J. BURLEY SMITH—The mining industry is quite as important, if not more so, than any of our other industries, and it seems to me an unwise policy to hamper its development by any tariff restrictions. At present we are only partially relieved of the duty. I refer to the stipulation in this Act whereby only machinery that is *not* manufactured in Canada shall be admitted duty free. It opens a question as to what machinery is free. For instances while rock drills as *a class* are manufactured in Canada, only two particular *kinds* are made—the Rand and Ingersoll. Yet in Europe at the present moment there are actually 34 distinct types of rock drilling machines, some of which contain improvements which were not even dreamt of at the time the Rand and Ingersoll-Sergeant were patented. Now does the law permit me to import any of these other *kinds* of drills duty free?

MR. B. T. A. BELL—Certainly; I do not think there can be any doubt about it. The Government provides you with a form of declaration in which you simply swear that the machine you are importing is of a class and kind not manufactured in this country, and the collector is bound to pass it. The law is good enough of itself; it is its operation at some of the ports of entry that is defective.

MR. S. P. FRANCHOT—According to the Canadian Patent Act it is necessary that the machinery—in order that the patent may be perfected—shall be manufactured within two years from the date of the patent. I am in favor of a deputation waiting upon the Comptroller of Customs and asking that the collectors be specifically instructed what machinery is entitled to free entry, and that the most liberal construction be placed by the collectors in their interpretation of the law.

MR. J. BURLEY SMITH—Do you not think that the fact of the importance of the extension and development of the mineral industries, we might with reasonable assurance ask the Government to take off the duty *in toto*?

CAPT. ADAMS—Hear! Hear!

MR. B. T. A. BELL.—The Government is perfectly liberal, but it must be expected to give reasonable protection to our own manufacturers.

MR. W. H. IRWIN.—Mr. Bell's conclusion is that the Act is liberal. The experience of my company has been different. The meaning of the Act is vague and ambiguous—it is so loosely worded that almost any thing we use in asbestos mining can be construed by the collector to be either directly or indirectly manufactured in Canada. Can Mr. Bell tell me just what machinery can be brought in free under this Act?

MR. B. T. A. BELL.—That would be a big contract. The whole essence of the Act lies in the words "class or kind." For instance rock-breakers as a *class* are made in Canada, but the types known as the 'Forster,' 'Wiswell,' 'Cyclone' and numerous other *kinds* of crushers are not manufactured, and we are entitled beyond a peradventure to bring in these free. The same applies to pumps, and all the various *kinds* of

John E. Hardman, S.B., M.E., Oldham, N. S. Vice-Pres. Mining Soc. of Nova Scotia.

specialties not manufactured here. The Department evidently is not posted on the details of the subject.

MR. E. B HAYCOCK—I have brought in a gold mill and other machinery and have never found any difficulty in getting entry duty free. I asked the Department if I could import a Cameron pump free and received a favorable answer.

CAPT. ADAMS—I wish to move that it is the opinion of this Association that the Dominion Government should remove all duties upon mining machinery.

MR. JOHN E. HARDMAN, (Halifax), said he had had considerable experience in the operations of the Act, particularly with reference to the importation of machinery for gold mining. At first they had found some difficulty in getting the Collector to arrive at a proper interpretation of the meaning of the Act. As an example copper plates were admitted free of duty, but when silvered for amalgamating purposes the Government, in order to protect a few silver plating works—who as a matter of fact had no bath large enough to take in these plates—charged the duty. Representations were made by the Gold Miner's Association with a result that a clearer understanding now existed in Halifax and there was comparatively little difficulty now in getting free entry for machinery. In every case where the form of declaration had been filled in the importer had never failed to get his machinery in free of duty.

MR. W. H. IRWIN.—Unfortunately our experience at the port of Sherbrooke has been very different.

MR. HARDMAN.—In Nova Scotia we have no fault to find with the Act.

MR. W. H. IRWIN.—While I quite sympathise with Capt. Adams' motion, I do not think any practical results can be obtained by passing it. I would move that a deputation from the association be appointed to confer with the Comptroller of Customs at Ottawa, with the object of obtaining, if possible, a definition of what machinery can be imported free under the Act.

MR. L. A. KLEIN.—I know of many instances where the duty on mining machinery has been collected in Quebec. I see no practical benefits the Act confers on our province.

MR. R. T. HOPPER.—Mr. Klein corroborates my experience.

Mr. Irwin's motion was then put to the meeting and was carried unanimously.

The following were appointed to wait on Comptroller: Messrs. Hector McRae (Electric Mining Co.), Ottawa; W. A. Allan (Little Rapids Mine), Ottawa; S. P. Franchot (Emerald Mining Co.), Ottawa; E. B. Haycock (Star Gold Mines), Ottawa; R. T. Hopper (Anglo-Canadian Asbestos Co.), Montreal; J. Burley Smith (British Phosphate Co.), Glen Almond and B. T. A. Bell, editor CANADIAN MINING REVIEW, Ottawa.

## The License on Powder Magazines.

MR. S. P. FRANCHOT asked what had been the outcome of the representations made by the Association respecting the repeal on the tax on powder magazines at mines.

HON. GEORGE IRNINE, Q.C.—A deputation waited on the Hon. J. S. Hall, Provincial Treasurer, at Quebec. We were received very favorably and he promised to give us a reply later on. He wrote the other day as follows:

QUEERC, 4th February, 1893.

HON. GEORGE IRVINE,

President Mining Association, Quebec.

DEAR SIR,—When the deputation of the Mining Association met me the other day, I promised an immediate answer. I saw a great deal of justice in the demand of the Association and delayed answering hoping to be able to give some relief this session, but, after carefully considering the matter, I don't see how I can open the question, but in the re-adjustment that will take place for next session, I have no doubt I will be able to accede, in part, to your request. I hope, therefore, you will see that the members of the Association pay what is due.

Yours truly,

JOHN S. HALL.

## Amendment to Constitution.

MR S P FRANCHOT Moved that Section 10 of the Constitution and By laws entitled "Duties of Officers" be amended by adding the following words:—

"A President shall be elected at the Annual General Meeting by ballot, and shall not be eligible for re-election to a third consecutive term of office."

MR. BELL.—We cannot consider amendments of this nature without notice of motion. Such a course would be irregular and would establish a dangerous precedent.

MR. FRANCHOT.—This is our adjourned annual meeting. We have a full attendance.

HON. GEORGE IRVINE.—I think Mr. Franchot's idea is common sense enough; but I do not think there is any common sense in making alterations to the Constitution without notice.

MR. FRANCHOT.—I think I am within my rights in asking for a vote.

MR BELL.—At the Annual Meeting on Wednesday I asked if it was the wish to read over the Constitution, with a view to the consideration of any amendments. It was too late now, without notice of motion and a special meeting called for the purpose.

MR. A. W. STEVENSON.—Moved the appointment of a committee to revise the Constitution and By-laws and submit any such to the next Quarterly General Meeting.

MR. BELL.—Seconded.

MR. L. A. KLEIN.—According to Constitution the Association should hold four meetings in the year, but the meetings had been held at the sweet will of the Secretary.

MR. BELL.—The meetings have been called by Council. No fewer than eight had been held during the past year. The September meeting had, however, been dropped. There was no use in calling the members together unless they had something to discuss.

Mr. Franchot's proposed amendment was put to the meeting and carried.

MR. W. H. IRWIN—Suggested that all the past presidents of the association should be appointed honorary presidents.

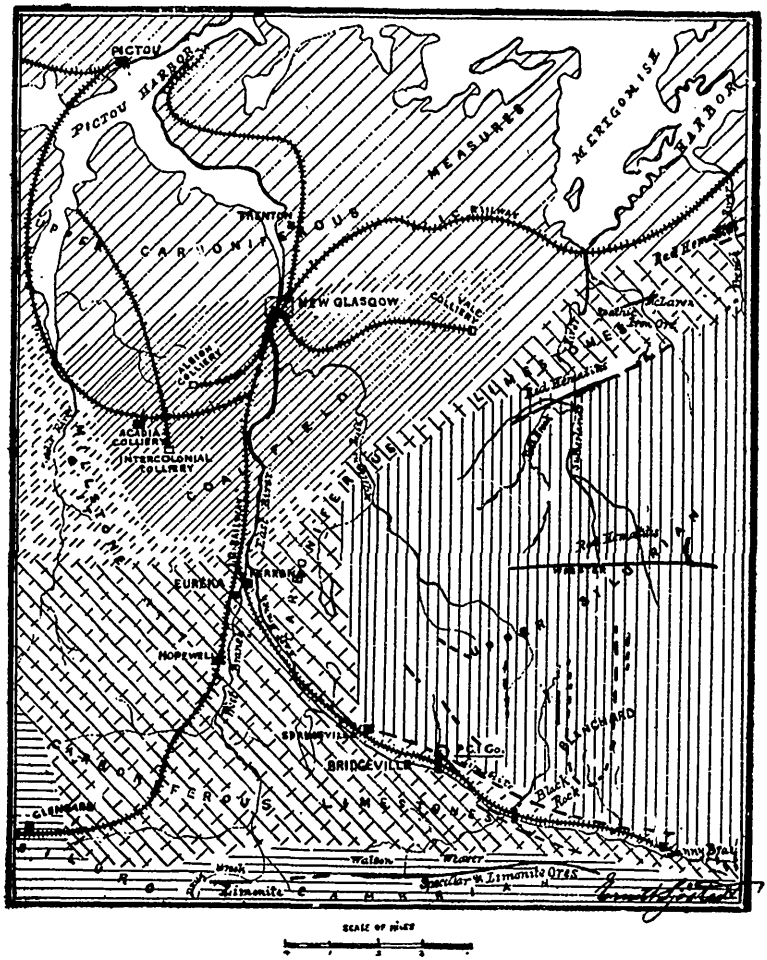
## The Secretary's Resignation.

MR. BELL reminded the Association that at the previous meeting he had tendered his resignation and that the office was therefore vacant. He regretted that the increased work incidental to the Association's operations seriously interfered with his business and compelled him to ask for the election of one better able to attend to their interests.

After some discussion Mr. Bell consented to officiate until the next quarterly general meeting on 7th April.

## A National Museum Wanted.

MR. BELL—On the list of resolutions unfortunately crowded out of the business at the united convention last evening was one which deserved the attention of this Association. He referred to the urgent necessity for enlarged and safer housing of the magnificent national collection gathered by the staff of the Geological and


PICTOU
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NEW GLASGOW
ALBION COLLIERY
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COAL FIELD
EUREKA
HOPEWELL
SPRINGVILLE
BRIDGEVILLE
CLIFTON
Limonite
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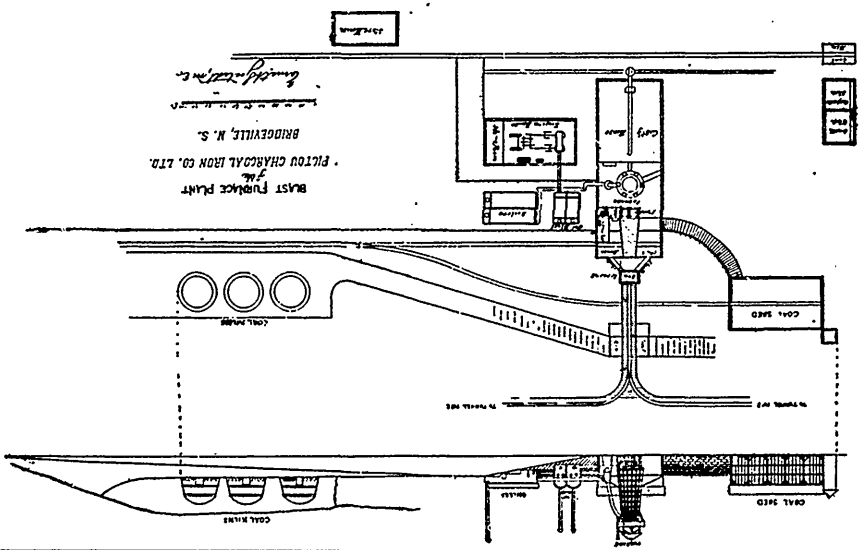
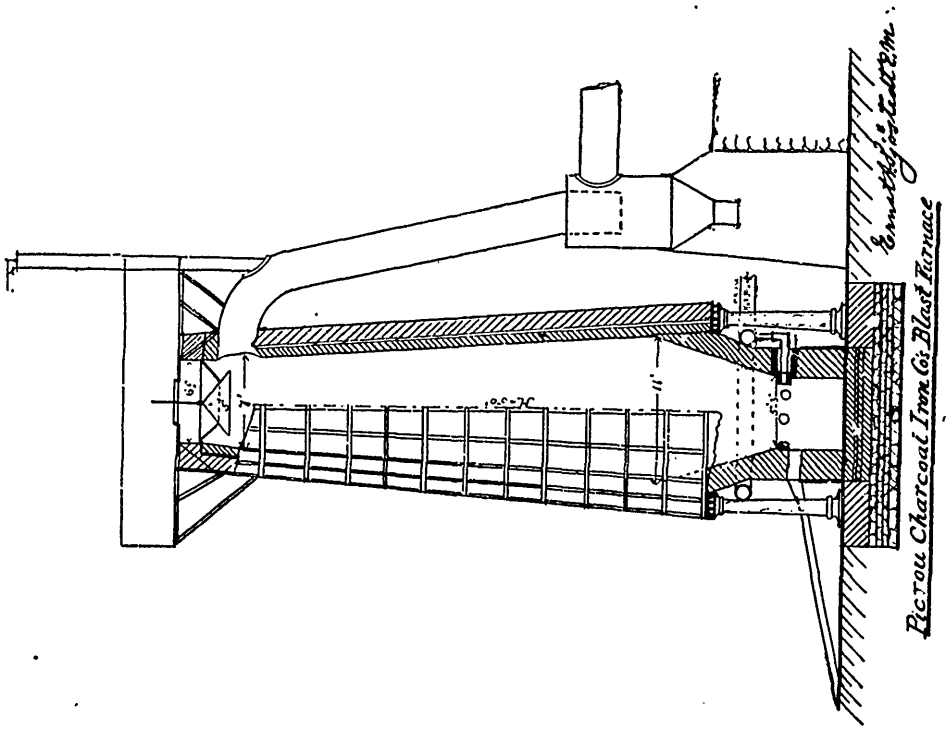
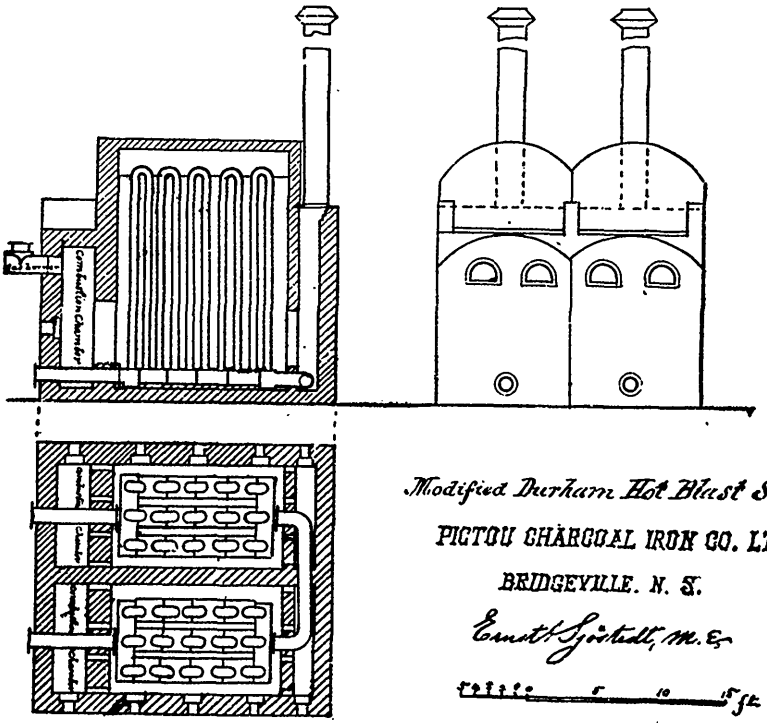

BLAST FURNACE PLANT
PICTOU CHARCOAL IRON CO. LTD.
BRIDGEVILLE, N. S.


Ernst Gjöstedt, M.E.
Pictou Charcoal Iron Co. Blast Furnace


Combustion Chamber
Modified Durham Hot Blast Stoves
PICTOU CHARCOAL IRON CO. LTD.
BRIDGEVILLE. N. S.
Ernst Gjöstedt, M.E.
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Natural History Survey of Canada. The building was antiquated and wholly inadequate to the wants and uses of such an important branch of the publicservice. Being contiguous to a tenement of stores it was in danger of being destroyed by fire at any moment. Thefloors were shaky and threatened to cave in. A large portion of the collection, for lack of accommodation was crowded into the open yard where valuable specimens lay exposed to the inclemency of the weather. The time was opportune to press upon the Dominion Government the urgent necessities of the case. The building contained the most precious collection of minerals, fossils, botanical and antiquarian specimens contained under one roof in the North American continent. The loss of such a valuable collection would be irreparable. The Governmeat had spent hundreds of thousands of dollars in exhibiting the resources of the Dominion in Great Britain and Europe and extensive preparations were being made for a costly exhibition in Chicago. In Ottawa the Government today could not show properly, even to the members of its House of Commons, the wealth of our country, many of whom are as ignorant of our great national resources as the veriest stranger who comes within our gates. He moved that the deputation appointed to interview the Comptroller of Customs, should, on the same day, seek an interview with the Hon. the Minister of the Interior and urge upon him the necessity of enlarged and safer housing of these great national treasures.

MR. W. A. ALLAN briefly seconded and the resolution carried unanimously.

### A Suggestion for Dr. Selwyn.

CAPT. R. C. ADAMS moved that the Association through the secretary, express to the Director of the Geological Survey its desire that the valuable photographs exhibited by Dr. Ells, during the discussion of his paper on the "Apatite Deposits of the Province of Quebec," before the United Convention, be reproduced in colors and issued as part of the Survey Reports.

MR. W. A. ALLAN suggested that the matter might suitably be brought to the notice of the Minister of Interior at the time of the interview anent the survey building.

### Votes of Thanks for the Courtesies Extended During the Convention.

MR. W. H. IRWIN moved that the hearty thanks of the Association be tendered to the following for courtesies extended to the Association and its guests:

Directors of the Victoria Skating Club.
President of the Montreal Amateur Athletic Association.
President of the St. George's Snowshoe Club.
President of the Thistle Curling Club.
President of the Montreal Snowshoe Club.
Governors of McGill University.
President Canadian Society of Civil Engineers.
Canada Iron Furnace Company, Montreal.
Col. A. A. Stevenson, Montreal.
Sir Donald and Lady Smith, Montreal.
T. G. Shaughnessy, Canadian Pacific Railway, Montreal.
The Dominion and Quebec Governments.
The meeting then adjourned.

## Meeting of the Mining Society of Nova Scotia.

The members of the Mining Society of Nova Scotia met in Lecture Room C., Physics Building, Montreal, on Wednesday afternoon, 22nd February. Mr. H. S. Poole, F.G.S., A.R.S.M. (Acadia Coal Co.) in the Chair. The hall was crowded; a number of members of the other mining organizations being present. The first paper submitted was that by Mr. E. Sjostedt, Bridgeville, N. S. entitled:

### Notes on the Ores and the Blast-Furnace Plant of the Pictou Charcoal Iron Co., Ltd., Bridgeville, N. S.

During the last few years much has been said and written about the "wonderful mineral resources" of Canada, especially of those in Nova Scotia.

Being attracted by these reports, as well as by the liberal inducement extended by the Government (at present consisting of a cash bounty of $2.00 per net ton on iron manufactured in Canada, form Canadian ores, and a duty of $4.00 on imported pig, or a protection of $6.00 per net ton, or $6.72 per gross ton), the writer, in 1890, decided to head a movement for developing these deposits. After much labor and time spent, a "prospecting company" was formed, the object of which was to ascertain where, in the Lower Provinces, there would be a suitable place for locating a charcoal iron industry.

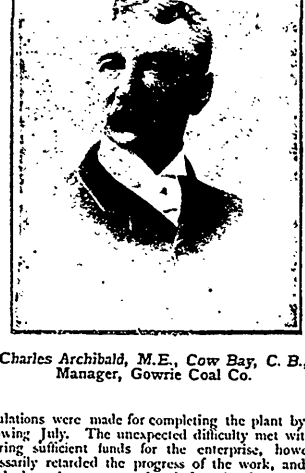
A charcoal iron plant seemed to offer the best inducements for investment as charcoal iron is made in Canada only on a limited scale, and 10,000 to 15,000 tons have been imported annually during the last few years. The greatest part of this importation is used in the manufacture of car wheels, and owing to the very extensive railroad systems now completed and under construction in this vast country, it is evident that the demand for this grade of iron is on the increase, and no doubt will soon assume important proportions.

An extensive prospecting tour was made throughout New Brunswick and Nova Scotia, and as a result of this exploitation the East River of Pictou, Pictou County, Nova Scotia, proved to be the most promising field for the industry in question, and a furnace site was eventually selected at Bridgeville, in the close proximity of the ore and limestone beds.

A glance at the accompanying sketch map of the iron and coal fields in Pictou County (see Mines Inspector Gilpin's paper in the Transactions of the Am. Institute of Mining Engineers, Vol. xiv.), is sufficient to show the favorable position this place holds. Situated on the line of junction of the upper silurian strata and the lower carboniferous limestones, where extensive deposits of limonites and large beds of pure limestones are found, it possesses the advantage of short haulage of ore and fluxes to the furnace; and as nearly all of the Silurian and Cambro-silurian districts here are well wooded, there are large tracts of old-growth hardwood available for charcoal making in the immediate vicinity, besides thousands of acres along the I. C. R. and the projected railway line of the Nova Scotia Midland, all inside of a radius of 25 miles.

The newly built railroad from Eureka Junction (on the I. C. R.) out to Sunny Brae, together with the above mentioned projected line out to the Atlantic coast, besides, not only furnish ample transportation facilities for the furnace material, but will give an outlet for the manufactured iron to the Intercolonial system of railways and to deep water harbors at Pictou and on the Atlantic.

Here mining rights for ore and lime rock were secured, a furnace site purchased and extensive tracts of hardwood land bought. These rights and properties were transferred to the Pictou Charcoal Iron Company, Ltd., at its organization in November 1891. The foundation of the works was laid before the winter set in, and plans and



*Charles Archibald, M.E., Cow Bay, C. B.,*
Manager, Gowrie Coal Co.

calculations were made for completing the plant by the following July. The unexpected difficulty met with in securing sufficient funds for the enterprise, however, necessarily retarded the progress of the work, and the year had nearly come to a close before the furnace could be put in blast. The annexed sketch gives plant and elevation of the works at Bridgeville in their present completed state.

The buildings consist of a convenient office, stables and store houses, a carpenter and blacksmith shop, a coal shed (with a capacity of 40,000 bushels), a carting house, stock house, and engine house. The shops and furnace buildings are all covered, roof and sides with corrugated iron, painted on both sides with mineral paint.

The working plant proper consists of the following structures:

The Furnace Stack (see accompanying sketch) which is 50 ft. high, with 11 ft. bosh and 7 ft. diameter under the bell. The conventional iron shell has here been dispensed with and substituted by a crinoline strapping and red brick shell. This, together with the 15 in. fire brick lining is supported by six cast iron columns, and the bosh is surrounded by a boiler-plate mantel, and the hearth by a water cooling cast iron jacket. The tuyers, six in number, are of bronze, and set in water coil breasts. The down-comer has a diameter of 36 in., and the bustle pipe 15 in. The top of the furnace is provided with a Weimer patent friction winch and gas seal for facilitating an even distribution of the stock, and to prevent waste of gas.

The hot-blast is a modified Cooper-Durham cast iron stove, with 30 U-pipes, and built in two sections and provided with two combustion chambers side by side, and so arranged that the cold blast inlet and the outlet of the heated blast, as well as the two combustion chambers, are placed in the same end of the stove (as seen from annexed sketch). This arrangement was successfully adopted by the writer some years ago at Katahdin Iron Works, Maine. Besides economizing space and blast and gas connections it facilitates maintaining the blast at a high temperature with a small amount of fuel-gas, the 2,000 ft. of heating surface sufficing to keep the 3,000 cub. ft. of air per minute (engine measure) up to 750° to 800° F.

The boilers are four in number (20 ft. x 36 ft.), made of best ⅜ in. Dalzel steel, and built in sets of two, with separate draft stacks, and independent steam and water connections, and provided with gas valves and combustion chambers similar to those in the hot blast, besides separate grates for wood or coal, in case of shortage of gas.

The Blowing Engine consists of two horizontal blowing cylinders of 5 ft. diameter and 5 ft. stroke and a pair of horizontal steam engines, 18 in. x 36 in., each one capable of performing the work in case of necessity.

The Elevator comprises a double Whitney hoisting machine and two Wood & Co's safety cages. These, as well as the limestone breaker (a Forster "crusher and pulverizer") are run by belt from a horizontal steam engine of about 15 h. p. capacity. And for the handling and weighing of the stock and the pig iron the Weimer patent steel charging barrows and Richle's furnace charging and pig metal scales are used.

Water supply has been provided for by building a 25 ft. high dam on Mill Brook from which the water is conducted 700 ft. through 3 in. wooden pipes to the furnace, besides which a reservoir is built (at an elevation of 75 ft. above the foundation level of the furnace) for collecting the spring water from the hills above, as well as the water pumped from the river. In case of lack of water from the above mentioned sources, a Northey duplex steam pump (7½ in. s. c. x 4 ½ in. w. c. x 10 in. st.) is performing this work, and a series of iron pipes are laid to the reservoir and to different parts of the works, and fitted with valves, hydrants and hose connections for fire purposes as well.

For the carbonization of the wood 19 brick kilns have been erected at different places. These are of the round (bee-hive) type, and each one holds 50 cords of wood, and is capable of carbonizing 1200 cords per annum, which will produce 50,000 bushels of coal. Those built in the woods are of the Plattsburg (conical type), each holding about 30 cords, and has an annual capacity of 700 cords of wood, or 30,000 bushels of coal. The present coaling capacity is, therefore, about 500,000 bushels per annum, requiring about 13,000 cords of wood. Three more kilns will be built in the spring, making the total capacity about 600,000 bushels of charcoal, which is the estimated requirement for producing 5,000 tons of pig iron a year. The wood used for the charcoal making is principally yellow birch, also beach and maple.

The iron ores on the north side of the East River of Pictou have been opened up in several places between Springville and Sunny Brae, and are at present worked by us, in two places on the Wm. Grant farm at Bridgeville, and by the N. G. I. C. & Ry. Co., both at Bridgeville and at Black Rock. They are contact deposits between the carboniferous limestones and the upper silurian measures, and consist of brown hematites, "residual precipitates formed from the disintegration of the older silurian rocks above," more or less mixed with pyrolusite, in form of nodules and masses, mostly in the hanging wall, but also as veins or crystals in the deposits themselves. On the south side of the river there are the Weaver and Watson specular ores, but these have as yet not been worked.

Our ore deposits being but a few hundred feet from the furnace, on a hillside on an elevation of about 100 ft. *above the same, the mining and hauling of the ore is* rendered especially easy. Two tunnels have here been driven, one on the east and one on the west side back of the furnace. The latter, or our "A tunnel" goes through a seam or vein of gravel ore, easily mined, and 10 to 15 feet in width. After having carried it in about 300 feet a slope was driven up through the ore, at an incline of about 45° S.W., to the surface 60 ft. above, which showed up a large body of ore, in some places 18 ft. wide. The ore in our "No. 2 tunnel" is of an entirely different character, being fibrous and compact, and requiring blasting. It is besides, richer in metallic iron, nearly free from manganese. This ore was first worked by an open cut on the top of the hill, as it displayed a remarkable deposit of solid limonite, yielding 58 per cent. metallic iron; and 3 to 4 thousand tons were removed. About 60 feet below this cut we have now driven one tunnel about 200 feet in the same kind of ore, besides an air shaft (at an incline with the dip of the ore of about 60 deg. south), and three different levels, all in ore from 10 to 15 feet wide.

The following analyses will serve to give an intelligent idea of the above mentioned ores:

| | Gravel ore from No. 1 Tunnel. | | Compact ore from No. 2 Tunnel. | |
|---|---|---|---|---|
| Insoluble matter..... | 12·80 | 6·75 | 8·58 | 5·58 |
| Metallic Iron..... | 45·02 | 53·41 | 54·83 | 56·57 |
| Metallic Manganese..... | 1·56 | 1·88 | 0·20 | 0·20 |
| Comb. Water..... | 9·45 | 11·02 | 10·00 | 10·90 |
| Sulphur..... | 0·05 | 0·04 | 0·41 | 0·09 |
| Phosphorous..... | 0·12 | 0·02 | 0·03 | 0·21 |

The variation in manganese and sulphur is, however, even more marked than the above figures indicate, as crystals of Pyrolusite and Barite are met with here and

there among the ore, without any regularity or warning. Our intention is to wash and roast our ore before using it in the furnace; but at present it is simply heap-roasted, with wood and charcoal braize, at the end of the tunnel track. From here it is afterwards carried on the tramway tracks (indicated on the plate H.) to the hute above the stock-house; and being here dumped on iron rails, placed about two inches apart, and broken sufficiently to pass through these, it falls on a wire netting (No. 10 gauge 3x3 mesh) down in the stock-house, whereby the dry clay to a large extent is screened through and separated from the ore.

The limestone used for flux is quarried at Springville, and from there hauled (3 miles) to our furnace, costing us about $5 cts. per gross ton delivered. It contains about 94·0% carbonate of lime; 2·5% carbonate of manganese; 2·0% insoluble matter.

Other valuable limestone deposits are found in several places near Bridgeville and at Black Rock and Sunny Brae, but of these only the one at Black Rock is opened up and worked—and this by the New Glasgow Iron Coal and Railway Co. The composition of this lime is reported to be as follows:—

| | |
|---|---|
| Carbonate of Lime | 94·30 |
| Carbonate of Manganese | 1·71 |
| Oxide of Iron | ·20 |
| Oxide of Alumina | 1·36 |
| Silica | 2·05 |
| Phosphorous | ·008 |
| Undetermined loss | ·372 |
| | 100·000 |

MR. GRAHAM FRASER (New Glasgow Coal, Iron and Railway Co.)—I have had great pleasure in listening to Mr. Sjostedt's paper. He goes very clearly into the matter, and gives a lucid description of the ore deposits of the East River of Pictou. I have no doubt that his company has a great future ahead of it. There is plenty of wood to make charcoal; and if that fails, we have the coal districts as a corps de reserve, to say nothing of coke iron. I must thank Mr. Sjostedt for the pleasure I have had in hearing his interesting paper.

MR. SMAILL (Londonderry Iron Co).—I know the ores used by the Pictou company. Their average last year was about 52 to 56 per cent. of the metallic iron, and was very rarely below 52: generally over 55, just as it comes from the mines. There is one thing about the gravel ores of that district—they take imitative shapesin their deposits.

I think, Mr. President, that Mr. Sjostedt and Mr. Fraser might add a great deal to the Society's collection of iron ores; and I think the Society ought to ask them if they would not add their specimens to the collection.

Do I understand Mr. Sjostedt to say that in all cases the ore he mines is a contact deposit, and that it is taking the place of limestone, washed away by percolating waters.

MR. SJOSTEDT.—It is so considered by most geologists. Our works have been carried on only a short time. The ores are decidedly richer than any similar ores found in Alabama, and are of great promise so far as we have gone. They are more regular than most similar ore in Alabama. In regard to Mr. Smail's suggestions, to send samples, I may say we have exceptional facilities for getting samples, and we will be glad to send the Society some at an early date.

Hon. W. S. Fielding, Halifax, Premier of the Province of Nova Scotia.

## Electrical Coal Mining.

MR JAMES T. BURCHELL (Gardener Coal Company), said: From the rapid increase in the number of coal mining machines used, the increasing quantity of coal produced by machinery, and the fact that in many collieries where machine mining has been tried the number of machines is being increased, I think that we can take the ground that the practicability of cutting coal by machinery is an established fact.

Any one that is at all familiar with the reclaiming of coal by this means will readily concede that it has many advantages over coal cutting by manual labor. First among these, and most important, is economy of production. Second, saving of coal or rather greater proportion of large coal and less slack or culm. Third, less powder required to blow down the coal, as the undercut is so much deeper. All mining men will readily understand the advantage this is to the coal. Fourth, less pit-room required for same output, consequently less number of tracks to be laid. Fifth, much less danger to workmen, as a large percentage of accidents occur to miners while undercutting. The fact then established that the coal mining of the future has to be done by machinery if we are to compete successfully in the production of coal, it is important to consider the machine that is most suitable for the work required and the most economical way to transmit power to drive it.

In considering the first point, I would say that many different kinds of coal cutting machines are now being successfully used, all of which have their advocates, but the types of machines that so far have done the most successful work are those of the reciprocating pattern such as the Youch, Harrison, Ingersoll-Sergeant and the Sperry, and the Rotary or revolving pattern as represented by Jeffrey, Leichner, Thompson, Van Depoele, Schlesinger and Edison. Those of the first named pattern attack the coal by a blow as with the pick, and as they are under the complete control of the operator can be guided so as to perform the work in coal and avoid contract with iron or sulphur balls that it would be impossible for the Rotary machine to work through. They have the advantage of being much lighter, some of them weighing only about 500 lbs, consequently are easier to move from room to room, and the cost of the machine is less than those of the other pattern.

The working of these machines is harder on the operator and requires more skill in handling than those of the Rotary pattern. The Rotary or revolving machine will do better work and more of it, with less labor for the operator, when the circumstances are favorable for its successful working. Where the seam is thin it requires an even floor, must have the coal clear of impurities of a hard nature and requires a good roof, in fact all mining machines require this, as timbering close up to the face of the work would be very much in the way of the machine. The Rotary machine being of greater length than the others requires a stronger roof, the lighter machine having a better chance to work around the timbers.

Neither of these types of machines can be expected to give satisfactory results in all mines or all classes of coal, and if this fact were better understood there would be less prejudice against coal-cutting machines, a more intelligent investigation into the question of adaptability of the machine to do the work required, and I am confident it would lead to a much more rapid increase in the use of coal-cutting machinery.

In Cape Breton the Ingersoll-Sergeant is worked successfully in the Emery colliery of the Sydney & Louisburg Coal and Railway Co., in the Gowrie mine of Messrs. Archibald & Co., and at the Caledonia colliery, where I am told the plant is to be increased.

The machine that I am most familiar with is the Jeffrey Electric Coal-Cutting machine. This machine consists of a bed frame 2 feet wide, by 8½ feet long composed of two steel channel bars firmly braced, the top plate on each forming racks with teeth downwards into which the feed wheels of the sliding frame engage. Mounted upon this is the sliding frame upon which is placed the electric motor from which power is transmitted through straight gear and worm wheel to the rack by means of which the sliding frame is fed forward. Upon the front end of the sliding frame the cutter bar is placed. The cutter bar contains steel bits, held in place by set screws—this bar is driven by an endless chain. The machine is operated by two men—it is run up to the face of the work on a truck, unloaded and firmly jacked against the face of the coal, and the roof in rear of the machine. The power is then turned on by the man in charge of the machine and it proceeds to work, the cutter bar being revolved by the endless chain is fed forward to a distance of five feet, making a cut of that depth, three feet three inches wide and four inches high. When the cut is completed the lever is reversed and the cutter bar withdrawn. The jacks are slackened down and the machine is moved broadside across the width of the cut placing it in position for the next cut. After the room is then cut entirely across, the machine is loaded on the truck and removed to the next room.

When we come to consider the second point, the most economical power to use, I know I am treading on dangerous ground. The question of electricity versus compressed air, has been a battle ground for the past few years. One of the strongest papers that I have noticed in favor of compressed air as against electricity is by David J. Lloyd, manager of the Edinburg Coal Co., published in the *Colliery Engineer* of December last, in which he shows a loss of 68 per cent. of power from the generator to the motor, or only an efficiency of 32 per cent. of the power conducted by electricity, also a loss of 40 per cent. from the engine as developed by the generator, making in all a loss of 81 per cent., or only 19 per cent. efficiency of power of engine produced at motor. While his compressed air plant shows a loss of only 34 per cent. from steam to air, and a loss of 7·4 per cent. from the compressor to the mining machine. I do not think that this is a fair comparison, as Mr. Lloyd admits that the electric mining machine that he tried was a failure and never made a single complete cut. Mr. Lloyd figures the loss of 68 per cent. from generator to the cutting machine, because his generator was developing 23·5 h.p. and his motor on machine was rated only 7½ h.p. He admits that there was no loss on the wires, so that the full current of 23.5 h.p. was delivered at the machine. Now it is quite clear that if the current was delivered at the machine his motor, although only rated at 7½ h.p., must for the short time it worked have developed 23.5 h.p., less loss of the efficiency of the machine, but as Mr. Lloyd does not take this loss into account in estimating the power of his air machine, it need not be considered, so that we can at once strike off the 68 per cent. loss. The loss he shows from the generator and engine, 40 per cent., although only 6 per cent. higher than he shows from the engine and compressor, is at least 10 per cent. greater than is usually found in well designed steam and electric plants of similar size, this I think can be accounted for in his case by the use of an engine at least double the size he required to do his work, which would double the percentage of frictional loss of the engine, as steam engines are usually found to show about the same loss of friction irrespective of load.

Applying to one of the largest manufacturers of compressed air and electric mining plant in the United States for a comparison, I secured the following reply. "We consider electric power the strongest, steadiest, mosteconomical and the simplest to handle. The loss in transmission of power from power house to mine is less with electricity than with the air. The liability of leaks in pipes, also friction is greater with air, so much so that in mines where we have the air power in use, we have a loss some days as high as from fifty to sixty per cent., while at other mines, the same distance with electricity, the loss is less than thirty per cent."

In my own experience I have not found nearly as much loss, I have tested the current day after day when the machine, with motor, was 800 feet from generator, and found the loss not to exceed five per cent. This loss can be almost completely overcome by increasing the size of the conductor so that resistance will be lessened in the transmission, and by proper insulation. Many of the mines in the United States are wired with bare wire without any insulation.

I append hereto a tabulated statement prepared by the Chief Inspector of Mines of the State of Ohio, who, accompanied by three expert electricians, visited eleven collieries where electric machines were in use, opened the circuit at each machine and inserted an ampere and volt meter and recorded the reading every fifteen seconds throughout the cut. This statement shows the h. p. required to overcome the frictional load to be between five and six, and that only six h. p. is required to cut a square foot of coal in a minute in some cases, and in others fourteen h. p. is required. This great difference is due to the fact that the coal is much harder in some mines than others and also to the cutting bits becoming dull, the test being made under all these different circumstances.

I have often seen a cut made with sharp bits in four minutes, when in the same coal if the bits were allowed to get dull it would take ten minutes. An excellent paper on this subject by Mr. D. S. Bigge was read before the North of England Institute of Mining and Mechanical Engineers at Newcastle on February 13th, 1892, an ab-

stract of which appeared in the *Colliery Engineer* of April last, in which he speaks strongly in favor of electrical power. This paper, I would advise, every one interested in this subject to read.

The phenomenal advancement of the introduction of electricity as a motive power should lead any one intending to install a mining plant to carefully consider its many advantages, and although its advocates have met with many discouragements it continues to make rapid advancement, and I have no doubt that at no distant day it will become the leading form for the transmission of power.

Among some of the advantages claimed for electricity is that the power can be carried longer distances with less loss than by any other means, and at less cost. The conductors requiring less space can more readily be put in position by less experienced workmen and connections for branch circuits more easily made than on conductors of any other power.

Electric power can be utilized for more kinds of work. I might mention coal cutting, hauling either by motors or electric hoists, pumping, running fans and lighting.

Having undertaken to run a thinner seam of coal than had previously been successfully worked in Cape Breton where so many large seams of coal exist, I found I was compelled to pay a higher rate for coal cutting than was paid at any of the other collieries. I commenced two years ago to enquire into the practicability of mining by machinery, and after careful examination of most of the machines worked in the United States, I purchased a Jeffrey Coal Cutting Machine worked by electricity, and had Messrs. Robb & Co., of Amherst, install an electric plant. The generator was 30 h. p. placed about eighty feet from the mouth of the shaft. We used No. O Okanite wire to conduct down the shaft and the ordinary insulated wire from foot of shaft to where the machine worked, a distance of seven hundred feet. The motor attached to the machine was rated twelve to fifteen h. p. I felt at the time that I was running quite a risk in attempting to run electric power, situated as we are, hundreds of miles from any one who knows the first thing about electricity; but the machine was put to work in September, 1891, and has worked constantly since, with the exception of the time the mine was idle in winter months. The machine never missed one day's work when we had work for it to do. Any repairs that it required were done on the ground and always in time for the machine to do its day's work. It takes from four to six minutes to make a cut five feet deep and three feet three inches wide. We have cut a room twenty-five feet wide across in fifty-five minutes. It takes thirty minutes to move the machine from one room to another. But we have had the best results when we have used the machine in Long-wall workings, where it has cut a face of one hundred and fifty-five feet by five feet deep in eight hours. When we have worked the machine on a face of Long-wall we have saved 30 per cent. in cost of cutting.

I make no claim for the superiority of this machine, but merely give my own experience. Other machines that I have not had any experience with may do as well or better. Several have been patented within the last year that give promise of doing efficient work. A description of one called the "Brown Coal Cutting Machine" invented by Adam Keil, of McKeesport, Pa., appeared in the July issue of the *Western Electrician* and has many excellent points.

While leaving the choice of machine an open question, I do not think there can be a doubt in the mind of any one who has had any experience with electricity, that it is far ahead of any other power when the work is at a distance from the power house.

There may be some types of machines working successfully with compressed air, to which as yet electrical power has not been applied, but this does not disprove my contention.

I have found in the use of electricity that the most important objections raised against it are imaginary. There is no danger to workmen from contact with wires, as it would require a current at least three times as strong as is generally used for mining purposes to cause the slightest danger from contact with even the bare wire, and there cannot possibly be any more danger of exploding gas by the flash from the brushes than there is from a naked lamp, therefore this agument cannot be raised against its introduction in Cape Breton where naked lamps are used in all our mines, still it must be admitted that in very gassy mines electricity as at present used would be attended with some danger. But the objection that is most often made use of is perhaps the most absurd one, that it is a new power that we cannot understand. If we refuse to make use of any power that we do not understand, I am afraid some of us would not do very much mining. I am not an electrician and must confess that I know very little about electricity, except that its power can be carried safely and economically from the surface to the most remote parts of a mine and there made to do efficient work.

THE CHAIRMAN—Mr. Burchell has read us a very interesting paper, and has thrown down several gauntlets which I hope will be taken up.

MR. R. H. BROWN (Sydney Mines).—How many workmen's labor does that 30 horse power that is developed save?

MR. BURCHELL.—It saves the work of eight colliers, and some days as high as sixteen. Although our generator is 30 h. p. we rarely make use of more than 15 h. p.

MR. HARDMAN (Oldham Gold Co.)—Whatever I may have to say, I do not wish my remarks to be construed as being the outcome of an advocacy of compressed air rather than electricity. I am not an advocate on either side, but take the point in criticism, that nothing has been said in Mr. Burchell's paper which would lead any one to believe that he has made any standard measurements. In other words, has Mr. Burchell indicated his engine so that he knows how much horse power is consumed so as to drive this 7½ h.p.? Compressed air must be understood distinctly as having a field of its own; and that in the dynamo work there is a limitation for each form of transmission. The transmission by wire rope has its own particular field. The transmission by compressed air has another field entirely its own, and the especial long distance transmissions are undoubtedly the field of electricity. I should like Mr. Burchell to state definitely what the power is that is delivered to his generator, and if he is prepared to say that the 7½ h.p. motor is not in reality a larger motor and does it not absorb more than the 23½ h.p., rather than indicated by the statement that it is simply a 7½ h.p. motor? My experience has been that the electrical companies could not or would not guarantee a definite percentage of power recovered from the initial power given.

MR. MEDBURY (Thomson-Van Depoele Electric Co.)—In reply to Mr. Hardman, and as an electrical man of electrical experience, I may say that my company, and I think all companies, will guarantee that the motor will show an efficiency of 70 per cent. of the power developed by the engine.

MR. BURCHELL—In reply to Mr. Hardman, I may say that our engine is larger than is required for the work, having made use of one we had on hand previous to purchasing our electric plant; it is capable of developing about 40 h.p., and when in its full capacity our generator indicates 80 amperes, 200 volts, equal to 30 h.p. We do not use this amount of current, as the work is generally performed with 50 amperes and 220 volts, between 14 and 15 h.p. Occasionally, when the machine gets into a very hard pan of coal, it runs up as high as 20 h.p., but when our motor is run at 14 h.p. the engine is only developing a corresponding h.p. Mr. Hardman, I think, has misunderstood part of my paper. The 7½ h.p. motor he referred to was one Mr. Lloyd had used.

L. A. Klein, M.E., Resident Engineer, Am. Asbestos Co., Black Lake, Q.

MR. J. BURLEY SMITH, (British Phosphate Co.)—To me it seems unfair to make any comparison between the loss in transmission of compressed air and electrical energy, unless the conditions under which both are tried are equal. For instance, it would be naturally unfair to say there was a loss of a certain percentage of compressed air in the transmission of a certain number of miles, unless it was quite certain that all the joints of the pipes were perfectly tight and there was no leakage in the distance.

MR. CHAS. ARCHIBALD, (Gowrie Coal Co.)—I think Mr. Burchell deserves great praise for being the first to use electricity for the purpose of coal cutting in Cape Breton. Yet I say, that so far, compressed air has the advantage, inasmuch as there has been no machine yet perfected to equal the Ingersoll-Sergeant coal mining machine. This machine has the advantage of being light, easily moved, and allowing the worker to handle it just like a pick, and avoid obstacles in undermining; and it can also shear coal, as well as under-cut it. On the other hand, the electrical is one that goes right straight ahead, and as there are many obstacles to be met with in undercutting coal, this machine would not be able to under-cut them with the same facility as the Ingersoll machine.

There is another advantage in air in my opinion; and that is, that it is more easily handled and safer for pumps and machines; and although I am not prepared to decide which is the best method, as far as I can see at the present time the compressed air, with the present machine, has the advantage. And while I believe a machine may yet be perfected that will probably put electricity ahead of compressed air, at the present time from my experience I am in favor of compressed air as a motor for using machinery in mines.

MR. SPRAGUE—In reply to Mr. Archibald's statement that compressed air is preferable to electricity, inasmuch as the Ingersoll machine is worked by compressed air, and that no machine has yet been perfected to work by electricity; I would say that an electrical machine worked on exactly the same principle and on the same pattern as the Ingersoll-Sergeant or the Harrison single blow pick machine, has been perfected and is giving excellent satisfaction. It has the advantage that it can be used as a shearing machine, if so required, by a change in its mounting. I would like to emphasize the statement of Mr. Burchell in regard to the fallacy of Mr. Hardman's argument against electricity as compared with air transmission. The statement he made that a 7½ h.p. motor consumed 23 h.p. from the generator was really a point in favor of the motor; which although rated at 7½ h.p. must have shown over 20 h.p. in actual work. In answer to Mr. Archibald's questions as to the danger of damaging an electrical coal-cutter because of the inability of the operator to tell when he was coming in contact with hard obstacles, it is only necessary to say that almost all electrical coal-cutting machines are provided with some sort of automatic cut-out or friction feed, which slips when an obstacle too hard to be cut by the machine is met with, allowing the bar to revolve without feeding forward. Another electrical machine, designed expressly for long wall working, is one carrying a cutting-arm which extends under the coal, making a four, five or six foot under-cut, as the thickness of the seam may require; the machine itself moving straight along the face; thus doing away with the lost time in withdrawing the breast machines, so called, and moving them broad-side along the face for the next cut. This machine in actual practice has cut at the rate of 60 feet a face per hour, making a four-foot undercut, at the Mead Run mine of the North Western Mining and Exchange Company, of Harrold, Penn.

MR. BURCHELL.—In reply to Mr. Archibald, I would refer to the statement in my paper that in some cases machines of the Ingersoll-Sargeant type could be used where the revolving pattern could not; but that the revolving pattern will do more and better work in any seam that it is adapted to. As to the danger of meeting hard substances in under-cutting, I would state that our electrical plant is fitted with an automatic cut-out that breaks the circuit when the machine meets any obstacle too hard for it to cut, immediately relieving the machine of the load and risk of breakage.

Before leaving home I wired the Jeffrey people asking them how many cutting machines they had in use worked by air and by electricity, and the nature of those installed in the mine of late, and they replied that they had 98 electrical and 60 air machines; and that within the past three years all new plants installed were electrical, and any air machines put in, in that time, were merely extensions of the old plants.

In reply to a further question of the chairman, Mr. Burchell stated that the machine was worked along the face of the coal at right angles to the levels.

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## The Dominion Government Grant to Scientific Societies.

MR. B. T. A. BELL (Ottawa).—I made a suggestion at a meeting in Halifax that the Society should apply to the Government for the grant usually given to scientific societies. I do not know whether anything has been done in this direction?

MR. W. HAMILTON MERRITT (Toronto).—I might say in this connection that when agricultural societies and many other societies get Government grants the mining institutions of Canada should receive greater consideration than in the past in that direction. All mining men are not rolling in wealth, and mining societies if they had a Government grant could do a great deal of good. Now, if each province of our Dominion thought proper, it might organize a society such as our Nova Scotia and Quebec Societies, and in some way or other they could conjointly send delegates, or each society send a member, all to act as a committee in matters requiring Government assistance or legislation.

THE CHAIRMAN.—You would not be afraid that if we applied and got such grants it would be calculated to close our mouths to the uttering of any independent criticisms of the legislation of the Government?

MR. BELL.—We would simply ask the Government to give us a grant to aid in publishing and distributing literature on the mining practice and mineral resources of the country. By publication of papers and discussions in our volumes of Transactions we are promoting knowledge and bringing the mineral wealth of the country into prominence.

THE CHAIRMAN suggested that Mr. Bell might make his suggestion before the United Convention of the Societies on the following day.

The meeting adjourned at 5 p.m.

## Combined Meeting of Canadian and American Mining Men.

On Thursday afternoon, 23rd instant, a combined meeting for the discussion of papers by the Canadian delegates opened in the Lecture Hall "A," Physics building. There was a large attendance, delegates being present from the American Institute of Mining Engineers, the Mining Society of Nova Scotia, the Asbestos Club, the Provincial Mining Association of Ontario and the General Mining Association of the Province of Quebec. Capt. Robt. C. Adams, Montreal, Vice-President of the General Mining Association of the Province of Quebec, presided. The proceedings opened at two p.m.

CAPT. ADAMS.—I need not say that it is very gratifying to see such a large and representative attendance at this our first united meeting. We have been penned up in our respective divisions, each endeavoring to do good work; but now, united in an international and continental gathering of mining men, we are to have a number of papers and subjects submitted for discussion. I trust that when we tackle some of the hoary abuses that will be brought to our notice, we shall really see the fur fly.

## The Mining Laws of Ontario.

MR. A. BLUE (Director of Mines) Toronto: For three quarters of a century Ontario was known as Upper Canada. For two thirds of that period it had a Legislature and Executive of its own, and for the rest of the time it was united with Lower Canada, now Quebec. The union of the two provinces ended with June, 1867 and on the first day of July Upper Canada became a member of the new Confederation with the name which it now bears. Three years before this date the first statute regarding mines and mining was enacted by the Legislature of the United Provinces, having for its title "The Gold Mining Act." This and the Amendment Act of 1865, were the only statutes which dealt with mines and mining down to the date of Confederation; all other control was exercised under the authority of Orders in Council and by reservations in the patent from the Crown. Under the latter provision gold, silver, copper, tin, lead, iron and coal were so reserved down to the end of 1823, and gold and silver until the 13th of July, 1860, when a Regulation was approved by the Governor-General-in-Council directing that in all letters patent for lands the clause reserving mines of gold and silver be omitted.

The necessity for exercise of Government control over mineral lands and mines arose in 1845, the first year of exploration and discovery on the north shore of Lake Superior. At first each case requiring executive action was dealt with by Order in Council as it came up, but in the course of time certain principles were evolved to which general application was given under the form of Regulations. These, however, were changed six successive times within the space of one year, and after a seventh modification in January of 1847, they stood unaltered for nearly seven years. For license to occupy a location and open mines thereon priority of discovery by exploration was a first requirement; but no license could issue until the explorer reported the result of his discoveries to the Government. It was also necessary that a scientific agent of the Government should have an opportunity to mark the boundaries of limits, determine the direction of boundary lines in the case of different courses of veins on adjoining locations, and examine the statements of exploration furnished by an applicant. Reports pointing out and selecting a location were classed according to receipt and held to be the best evidence of discovery; possession by the building and occupying of a hut was proof of the next value; while priority by application was assigned a third rank of value. The extent of a mining tract was first fixed at one mile in front by five miles in depth; but afterwards, in response to the petitions of explorers, the limit was extended to two miles in front by five in depth, the length to be with the course of the mineral vein. The land was sold in fee simple at eighty cents (4s.) per acre, $600 payable at the time of purchase, or when the certificate of location was issued, to cover the cost of surveying and other contingent expenses, and the balance in five yearly payments with interest. Upon these terms the lands on Lakes Huron and Superior were declared open for sale at the minimum price of four shillings per acre, in blocks of ten miles square; and although it was provided that all grants should be subject to such regulations to ensure the working of the mines as Parliament might thereafter enact, it does not appear that any conditions were required or imposed by that body.*

After a trial of seven years the Government became convinced that these Regulations were too burdensome upon the miners. The system of allotting mining tracts had not realized the anticipations formed of it; neither had it enabled individuals desirous of engaging in mining pursuits to effect their objects without compelling them to purchase locations of so extensive an area as to call for a needlessly large outlay on acquiring a right to explore and mine where the signs were favorable. Accordingly, in September, 1853, a new set of Regulations was introduced by Order-in-Council, applicable to Upper Canada only, under which the Commissioner of Crown Lands was empowered to issue to any person upon payment of $100 (£25) a license to explore unceded lands in any county or section of the province (named or described in the license), for copper, lead, iron, tin, marble, gypsum, earths or minerals. The license was to remain in force two years, and the holder of it might take possession of a tract not exceeding 400 acres of unoccupied land, 40 chains front by 100 in depth, and "report his discovery and selection accurately by letter and map within six months from the issue of the license, accompanied by an affidavit made by himself and some other credible person proving that no counter occupation or workings exist." At the expiration of the term of two years the licenseholder was required to complete a purchase of the tract selected by him at the rate of $1.50 (7s. 6d.) per acre in one sum, or forfeit his right. It will be observed that these Regulations did not apply to gold and silver, unless they could be included under the general designation of minerals. In the next Regulations, adopted by Order-in-Council in March, 1861, gold and silver were specifically excluded, as doubtless it had been intended all along that they should come under the Regulations of 1845-7. The new regulations also abolished the fee of $100 for permission to explore, and provided that locations be sold to the first applicant agreeing to the following conditions, viz.: "That for mining purposes tracts comprising not more than 400 acres each be granted to parties applying for the same at the rate of $1 per acre, to be paid in full on the sale," the applicant furnishing a plan and description of the locality to the Department of Crown Lands, "and on condition that such mineral location be worked within one year from the date of said grant." It was further provided that a patent should not issue until two years from the date of the purchase, and then only upon proof that the purchaser or his assignee had continued to work the location *bona fide* for at least one year previously.

In April of the following year working conditions were abandoned as to future sales, and it was agreed that patents should issue on the payment of the purchase money, but subject to a royalty of 2½ per cent. on ores raised or mined, payable on their value as prepared for market at the mine.

In March of 1864, the royalty of 2½ per cent. was changed to a tax or duty of $1 per ton on all ores except gold and silver, payable on removal from the mine, and this condition was made to apply to all mining lands sold under the Regulations of 1862. It was also provided by the amended Regulations of 1864 that not more than one tract of 400 acres should be sold to one person.

The new tax or duty remained in force only one year, a Regulation of April, 1865, directing that the clause requiring such payment should no longer be inserted in the grant or patent. The same regulation also authorized the Commissioner of Crown Lands at his discretion to omit the clause reserving mines of gold and silver in patents for lands on the shores of Lake Huron and Lake Superior.

The last of the Regulations for the sale of mineral lands by Order-in-Council was brought into operation in July, 1866, and dealt chiefly with ores of the base metals. They provided for the sale of mining tracts in unsurveyed territory in blocks of 200 or 400 acres; the survey of tracts at the cost of the applicant by a Provincial Land Surveyor; the furnishing of plans, field notes and descriptions showing the connection of a tract with some known point in previous surveys, so that it might be laid down in the office maps of the territory; and payment of the price at $1 per acre at the time of making application. The Regulations also provided that lands in unsurveyed territory should be sold by the Department and in surveyed townships by the local agents, and that in all letters patent for lands the clause reserving gold and silver be omitted.

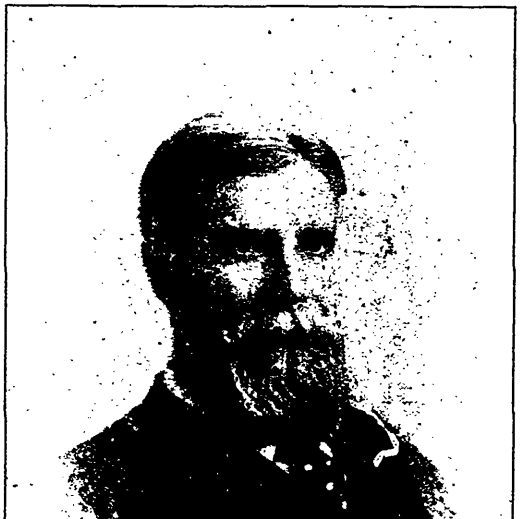
In 1864 there was a rush of miners and prospectors to regions of Lower Canada in which alluvial gold had been discovered, chiefly on the St. Francis and Chaudiere rivers and their head waters; and in that year, as already mentioned, the Legislature passed the first Act on the subject of Mines and Mining, known as "The Gold Mining Act." It was a statute of 40 sections, drawn up with much nicety and particularity for the mining of alluvial and quartz gold and the protection of miners' rights, for appointment of inspectors of divisions with large powers, for staking out claims of small areas, for licenses to mine, for licenses to mill, for sworn returns of gold taken out, for preservation of the peace, and in short all the trappings which the wit of legislators might devise for conserving the interests of the Crown and protecting the rights and fixing the obligations of miners in a placer diggings gold land.

The rush of miners and prospectors to the Chaudiere Valley was of short duration. Yet the Act of 1864 not only remained with trifling amendments the law of the country down to the end of the union of Upper and Lower Canada; it continued to be the law after Confederation, when the exclusive powers to make laws for management and sale of public land belonging to each Province was assigned to the Provincial Legislatures by the new Constitution, the British North America Act. A good reason for its continuance in Ontario was found in the discovery and working of veins of gold quartz in the county of Hastings, which had been set apart as a Mining Division under the Gold Mining Act on the 17th of November, 1866, ten days after the Commissioner of Crown Lands had received information of the discovery of gold in Madoc.

Under date of November 6, 1866, Hon. Billa Flint, of Belleville, wrote the following letter to the Commissioner:

"MY DEAR SIR.—There is a great stir here at present about Gold in Madoc.

"Already one lot has been sold to Americans for



J. Burley-Smith, M.E., Manager, British Phosphate Co., Glen Almond, Que.

* The Mining Location ticket issued under the Rules and Regulations of the Order-in-Council, of the 7th October and 2nd November, 1846, contained the condition that if the locatee should neglect to commence and bona fide carry on mining operations upon his location within the period of eighteen months from the date thereof, he should be held to have forfeited the location and license.

about $30,000, and the gold is very rich ; it also begins to be developed in other places in Madoc than on lot 18, Con. 5.

" My object in writing is to say to you that I believe it exists in Elzevir, Hungerford and other townships both east and west of Madoc, and my desire is to put you on your guard as to sales of land, as the people are going mad about lands for mining purposes.

" I have for years been satisfied that there was a vein of gold running somewhere about east and west across the Back Country, and have had several specimens from quartz rock for the past five years.

" I know geologists will not admit that we have mineral wealth, but I do know that they cannot tell where mineral is till we find it for them ; and I have no faith in their statements, for when I have given Sir Wm. Logan specimens he went return them, not tell me what they are.

The present excitement if kept up for a short time will bring our rocky land to high figures. Lands near this Gold discovery that could have been got for $4 an acre $10 is refused for them now , this shows the sanguine feeling of both holders and purchasers.

So if there is any good chance, of which I have no doubt, let the Government enjoy for the good of the whole country the benefit by sale or leases.

Yours, &c., &c.,

BILLA FLINT.

HON. A. CAMPBELL,
Commissioner of Crown Lands,
Ottawa.

On this letter the Commissioner made a memorandum as follows :

" I have no faith in the gold being found in paying quantities ; the Chaudiere country promised much greater riches, but the only persons who have made any money there have been speculators on the delusion of others in the price of lands, and the few who found gold in alluvial deposit. If there be any gold in the townships named by Mr. Flint it is *in situ* and the expense of working it will be found to reduce the affair to the laws of ordinary industrial pursuits. The lands however in the townships named should be treated as gold lands are in Chaudiere —sold at a price of $2 per acre cash, subject to Gold Mining Act —A. C."

In the first session of the Legislature of Ontario after Confederation the Act of 1804 was repealed, and one known as " The Gold and Silver Mining Act of 1868 " was enacted in its stead, —provision for silver mining having been deemed necessary as a result of discoveries on the north shore of Lake Superior in the previous year. The new features of this Act related chiefly to the granting of licenses to explore and mine for gold and silver within the limits of a mining division and to the levying of royalties. Under the former Act a miner's license was was of two kinds, viz., (1) a Crown Lands license, which upon payment of a fee of $2 per month authorized the holder to mine on any unsold public lands, and (2) a Private Lands license, which upon payment of a fee of $1 per month and after agreement with the proprietor authorized the holder to mine on any private lands within the limits of the division. Under the latter Act the fee for a license was reduced to $5 per year, and it authorized the holder to explore and mine for gold and silver upon any public lands in a division, but subject to the levy of a royalty of not less than two nor more than ten per cent. on the gross amount of gold or silver mined —the rate to be fixed by the Lieutenant-Governor in Council and variable for different mining divisions and different mines according to the yield. Proprietors of private lands were accorded the right to mine for gold and silver upon their own lands, subject to the royalty, and private licenses were abolished.

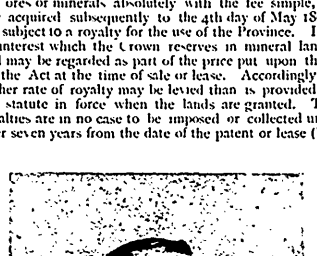
In the following year this Act was repealed, and there was passed in place of it " The General Mining Act of 1869," a measure which for the first time dealt by legislation with ores and minerals of all classes. It however retained most of the provisions of the former Act, applying them to the occupying and working of "mining claims" under miners' licenses when situate within any mining division, but abolishing the provisions relating to alluvial mines. Larger areas were designated as " mining locations," consisting of 80, 160, or 320 acres, the price was fixed at $1 per acre, and if the locations were in unsurveyed territory it was necessary to make a survey and file plans and descriptions as required by the Regulations of 1866. To a large extent, indeed, the old Regulations became in this measure crystallized into statutory law. By this Act, also, all royalties, taxes and duties reserved by any patent theretofore issued in respect of any ores of minerals were declared to be repealed and abandoned ; all reservations of gold and silver mines contained in any previously issued patent were rescinded and made void ;* and it was provided that no reservation or exception of mines or minerals should thereafter be inserted in any patent from the Crown granting any lands sold as mining lands.

These general references to the Act of 1869 will suffice to exhibit the course of the development of mining legislation in our province ; but I pass by the details and take up the law now in operation.

In "The Mines Act, 1892," the Act of 1869 and all subsequent Acts dealing with mining lands, mines and mining, have been consolidated and amended. It consists of four parts, viz., general provisions, mining locations, mining claims and mining regulations, and for convenience it may best be considered under these several heads.

The administration of the mineral lands is presided over by the Commissioner of Crown Lands, and connected with his Department is a Bureau of Mines, established to aid in promoting the mining interests of the province. The Director of this Bureau acts under the instructions of the Commissioner, and is clothed with all the powers, rights and authority which an inspector or local agent may exercise in a mining division or locality, and such other powers as may be assigned to him by regulation for carrying out the provisions of the Act. In practice the Bureau has charge of the mineral lands in surveyed territory (unsurveyed territory is in charge of the Department), and through it all correspondence and business relating to the selling, leasing and working of such lands is carried on. It also publishes an annual report to furnish information on the mineral resources of the Province, the progress of mining and metallurgical operations, the condition of mines as regards the health and safety of miners and the observance of regulations for the employment of labor.

As in the original Act, any person may explore for mines or minerals on any unoccupied Crown lands, and such lands, if supposed to contain ores or minerals may be taken as mining locations or, if in a mining division, as mining claims. But lands so taken do not now carry the ores or minerals absolutely with the fee simple, as any acquired subsequently to the 4th day of May 1891, are subject to a royalty for the use of the Province. It is an interest which the Crown reserves in mineral lands, and may be regarded as part of the price put upon them by the Act at the time of sale or lease. Accordingly no higher rate of royalty may be levied than is provided by the statute in force when the lands are granted. The royalties are in no case to be imposed or collected until after seven years from the date of the patent or lease (but



S. P. Franchot, Managing Director, Emerald Mining Co., Buckingham, Que.

extended in the case of original discovery to fifteen years), and then they are to be calculated upon the value of the ores or minerals at the pit's mouth less the actual cost of labor and explosives employed in raising them to the surface. In this way and under these conditions, silver, nickel and nickel and copper ores are subject to a royalty of three per cent., iron ore to two per cent., and all other ores to such royalty as may be imposed by Order-in-Council not exceeding three per cent.

Mining locations are required to be of definite form and size, whether they are situated in unsurveyed territory or in townships surveyed into sections or lots. In the territory beyond Lakes Superior, Huron and Nipissing and the French and Mattawa rivers, wherein for the most part the great mineral-bearing formations of the province lie, each location in a surveyed township must consist of a half, a quarter, an eighth or a sixteenth of a section ; and if in unsurveyed territory it must be of rectangular shape with outlines of astronomical bearings, containing 320, 160, 80 or 40 acres, surveyed at the cost of the applicants and connected with some known point in previous surveys, or with some other known point or boundary. The price of such locations ranges from $2.50 to $3.50 per acre, dependant on its distance from a railway and whether it is in surveyed or unsurveyed territory. For locations south of Lake Nipissing the price ranges from $2 to $2.50 per acre. Any greater sum, however, may be charged where a district or locality rich in mines or minerals has been set apart by regulation under Order-in-Council, or the land in such a locality may be temporarily withdrawn from sale.

The applicant for locations has the choice of obtaining a grant in fee simple at the prices named above, or he may obtain a lease at $1 per acre for the first year and 25 cents per acre for each subsequent year, if the lands are in the territory north of the lakes ; if south of the lakes the first year's rental is 60 cents per acre, and 15 cents thereafter. Leases are issued for a term of ten years with a right of renewal for a further like term at the same rental, if the conditions have been observed, and thereafter they may be renewed from time to time every twenty years at such rent as the regulations provide. But the lessee may at any time become the purchaser of the lands held by him, in which case the sum paid for the first year's rental is treated as part of the purchase money. This leasing system appears to be growing steadily in favor with mining men, and a large proportion of the lands now granted for mining purposes are granted under its provisions.

Whether a location is held in fee simple or by lease it is subject to certain working conditions, being an expenditure during the first seven years after the issue of the patent or lease in actual mining operations of $4 per acre where the area of the location exceeds 160 acres, and of $5 per acre where it is of less area ; and such expenditure may consist of labor performed by grown men at the rate of $2.50 per day, or for explosives or other material for mining used on the location. In default of so much work by a *leaseholder* the lease becomes void and the location reverts to the Crown ; in a case of default by an *owner* all mines, mineral and mining rights so revert, but the owner retains all interests in the location as agricultural land.

Under the system of free grants to settlers adopted in 1868, all minerals have been reserved to the Crown, and by an amendment to the Public Lands Act in 1891, they are so reserved on all lands now sold for agricultural purposes. So it has come to pass respecting those lands that two classes of rights are recognized, viz. : surface rights and mining rights. The owner of the surface rights may apply for a patent or lease of the mining rights on his lot, and his claim possesses priority except where there has been an earlier application and a deposit of at least half the purchase price or rental made, or in case of original and *bona fide* discovery of valuable mineral by a subsequent applicant within one month prior to the application of the owner of surface rights. In either case the price per acre of a patent or lease is one half of the rates for a mining location where surface and mining rights are not separated. But a prospector is limited in his right to go upon private land on which the minerals have been reserved to explore it. He cannot enter any portion of a lot used as a garden, orchard, vineyard, nursery, plantation or pleasure ground, or upon which are crops that may be damaged by exploring, or on which is any house, church or cemetery, except with the written consent of the owner or locatee. Neither can the person to whom mining rights have been conveyed go on the land to open it for ores or minerals until he has first agreed with the owner of surface rights for compensation and damage ; but should the parties fail to agree it is in the power of the Director of the Bureau of Mines to order and prescribe the manner in which compensation shall be ascertained and paid or secured, either by an arbitrator appointed by himself or by a suit or action in any county or district court between the parties

It is to be observed that in all sales or leases of mining locations all pine trees thereon are reserved to the Crown, and should the locations lie within a timber limit the holder of a license to cut timber on the lands may enter upon them and cut and remove the trees. Yet although the patent or lease expressly reserves pine timber, the owner or lessee may cut and use all pine and other trees needed for building, fencing and fuel on the land, and for any purpose essential to working the mines upon it, as well as cut and dispose of all trees required to be removed in clearing the land for cultivation. But a lessee is restrained from using pine trees for fuel other than dry pine, and should he intend to clear any portion of the land for cultivation, he is required to give the holder of the timber license three months notice so that he may remove any pine on the area to be cleared. If at the end of that period it is not removed the lessee may cut and dispose of all trees on the land to be cleared, but subject to payment of the same dues as are payable by the holder of the license. The privileges of the lessee are also circumscribed in another particular. Should he during the first ten years seek to cut timber other than pine upon his location, beyond what is needed for building, fencing or fuel, or in the course of actual clearing for cultivation, or for any purpose essential to the working of the mines, he must first apply for leave to the Commissioner of Crown Lands, who may grant authority to cut the timber and fix the rate of dues to be paid upon it. But inasmuch as a lessee may forfeit and abandon his title to a location by the simple process of neglecting or refusing to prepay the yearly rent, it is not reasonable that he should be treated with the same liberality as an owner in respect to the timber upon the land. The important point is, however, that both owner and lessee of a mining location are entitled to the free use of all the timber upon it which may be wanted for mining purposes, while the owner is entitled to the free use of all timber, excepting pine, upon it for any purpose. The owner or lessee of mining or underground rights has of course no claim to use of the timber upon a location which, as far as it goes at all, goes with the surface rights.

The portion of the Act which relates to mining claims and the manner of acquiring, holding and working them is for the present inoperative, inasmuch as no tract of country has been declared or set apart as a mining division. The reason no doubt is that circumstances have not arisen to call for utilising the system for which it provides, either by reason of the distance of mining fields from surveyed or settled territory or the discovery of fields very rich in gold or other valuable ores were small areas would satisfy the desires of mining men. Mining locations are preferred, and there is not a demand for mining claims. Yet it is possible that the demand may arise in some portion of the vast mineral-bearing formations of the Province, and

*It has been stated that most of the patents issued down to the end of 1823 reserved for the Crown mines of copper, tin, lead, iron and coal, as well as of gold and silver, but inasmuch as only the two last named were by the Act of 1869 deemed to have passed with the lands to the owners in fee simple, it may be assumed that the right to the others in all cases where the reservation was made in the patent is still in the Crown.

in view of that contingency it is well to have a provision ready at hand, to which effect may be given at the will of the Executive.

In the Mining Act of 1864, the area of a claim which might be staked out by one person holding a license was less than half an acre, and by a company of persons not more than about 2¾ acres, and these areas were doubled by the Act of 1869. The Mines Act 1892 provides for staking out by one person a claim 660 feet along a vein by 330 feet on each side of it (about 10 acres) and by a company of persons a claim not exceeding at the maximum 1320 feet along the vein by 330 feet on each side of it (about 20 acres). But no person has the right to stake out a claim or to mine it who does not first obtain a miner's license, for which the fee is $5, and pay a year's rent for a claim at the rate of $1 per acre. A license is renewable only upon payment of the fee and of the annual rent for a claim, and the tenure of a claim depends besides on stringent working conditions. Adequate provision is made for the protection of miners' rights in a division, and for the enforcement of law and order under the authority of an Inspector.

The fourth part of the Act is chiefly designed to provide for the health, safety and well-being of miners through a proper and careful observance of Regulations for the working and management of mines; but as these follow pretty closely the British Mining Regulations any enumeration of their features would be superfluous here. The Inspector whose duty it is to look after their enforcement finds that owners and officers of mines are with rare exceptions desirons of doing liberally all that the Regulations require, and it does not appear that the employed classes have a grievance under them for which legislation could effect a cure.

MR. MCKAY, (Sault Ste. Marie), said—The objections, in my mind, to the levying of a royalty are, first, that it is merely a means of furnishing a revenue to the province; and second, that the bonuses and dues from pine limits will net the same amount to the province. Further, the price of mining lands at two and three dollars an acre for the portion of the province unsold would amount to about $150,000,000. From the standpoint of encouraging the development of the country, a high tax on land per acre would be preferable, as it would discourage the speculator and would not tax the company or individual in accordance with the development of the resources of the country. If a 3 per cent. royalty is not a high tax, we object to the Government singling out one specific industry to be the object of a direct tax. It is this fact that tends to discourage American or foreign capital to invest under the Ontario Mining Act; for the inventor who discovers a certain method of bringing together a certain material, for which he obtains from the Dominion Government, a patent, should be the object of a royalty as much as the explorer, who discovers the existence of mineral wealth. The inventor usually is paid by royalty, and it might be argued on the same lines as those which are urged on behalf of the royalty on minerals, that he should contribute to the province. Inventors would unanimously object to such a royalty being levied; and the answer of some manufacturers that he would not object to pay a 3 per cent. royalty on a good patent, does not dispose of the question any more than does the answer from one of our mine owners who operates under the old Act that he would not object to pay a royalty of 3 per cent. The royalty either comes out of the pocket of the explorer or the inventor; or out of the pocket of the capitalist, who uses the invention or the mine for the benefit of the public.

The mining industry requires every encouragement, and as the Royal Commission has said, the most legitimate means by which the people can really enrich themselves is by extracting the wealth from mother earth direct. The liquor traffic, in my opinion, out of which millions of dollars have been made by Canadians, should be made the object of additional taxation rather than mining.

PROF. C. G. RICHARDSON, Toronto.—If I am not mistaken, the Act especially provides that this royalty is in lieu of all taxes?

MR. A. BLUE.—Not in lieu of municipal taxes; and it is of course subject to the tax of one cent per acre, which the law imposes for local improvement purposes on lands which are not within municipal districts nor in incorporated townships.

PROF. C. G. RICHARDSON.—With the principle of royalty I have a great deal of sympathy. The only objection I take to the Mining Act of Ontario is in reference to the clause reserving from the miner the use of the green pine. This has caused a great deal of antagonism in the past between the miners and prospectors, and the holders of timber licenses. It is unfortunate that this should have occurred, since in very many instances fires have been set, no doubt wilfully, or at any rate through carelessness by prospectors when searching for minerals. The only way, so far as I can see, of securing immunity from danger in prospecting a wooded country would be to make the interest of the prospector identical with the interests of the lumberman and the interests of the country; that is, in the preservation of the timber from fire. I think it would be well if the prospector could be assured of the pine.

MR. BLUE—Well, he is assured of that right for mining purposes.

PROF. RICHARDSON--Only to use it for building and clearing, not for roasting. Green pine for roasting is worth its weight in gold.

MR. BLUE--The question has never been raised. That is justified in the Act.

PROF. RICHARDSON—Green pine?

MR. BLUE—Well, I think so.

MR. IAN. CAMERON, (Mgr. Dom. Mineral Co., Sudbury.)—I think the lumberman has got the right to use green and dry pine for his uses.

MR. BLUE—Under certain circumstances he has. Any location has the right to all timber upon it for any purpose; because most of the country up there is under timber limits. Timber limits have been disposed of here, and were disposed of before any minerals were discovered in the country.

MR. B. T. A. BELL—Doesn't the Mining Act make provision for inspection?

MR. BLUE—Yes; once or twice a year, or as often as may be necessary.

CAPT. PENHALE—I do not believe in the imposition of a royalty. I consider the Government should give greater encouragement to miners; for the minerals are of no use until they have been taken from the ground by the miner. I think the Government should remove every obstruction to mining. If they did, they would get more money out of the country, and would settle it rapidly.

MR. BELL—Capt. Penhale must not forget that up to the passing of the Act the mining legislation of Ontario was in a very bad state. The Government had sold lands for $1.00 and $2.00 an acre, and the result was that very large tracts of these valuable lands were locked up, and are locked up to-day, by speculators who hold them at large figures practically prohibitive to the development of mining. The Government is quite right in asking a fair price for lands. The idea of giving away valuable mineral land for $1.00 or $2.00 an acre without any condition as to its development was absurd. I think that while the Ontario laws may in some particulars require revision, they are in the main fair and equitable.

CAPT. ADAMS—It is important to notice that a feature of the present mining law is that no royalty will be levied on an industry for seven years, which gives a new industry a chance to establish itself. I think most

**W. H. Irwin, Anglo-Canadian Asbestos Company, Montreal.**

mining men will agree that if an industry lives for seven years it ought to be in a pretty healthy state. I think that is an admirable feature.

MR. IAN. CAMERON, (Mgr. Dom. Mineral Co., Sudbury)—I may say we have no objection whatever to pay the Government a 3 per cent. royalty if the mine can afford to do so. I think the Government is quite justified in selling its lands at any price it may see fit to put on them. If it chooses to sell lands at $3.00 or $3.50 an acre and say: "after seven years you shall pay a 3 per cent. royalty of the net profits of the mine," it is in my opinion perfectly fair. The State ought to have the royalties. I may say that in the last twelve months I have been asked by some six or eight people if my company would buy properties, and have been asked to pay from $20.00 to $1,000 an acre, and above that a royalty at from 25 to 50 cents a ton. I see no reason for the grumbling about a 3 per cent royalty. It is a bagatelle.

DR. SELWYN, Director Geological Survey.—In my opinion, a tax should be put upon the transfer of mining properties. In very many instances lands have been bought for one or two dollars an acre, and the owners have afterwards sold them for $150,00 to $200,00 an acre; and these men, after making a large deal, simply walked off with their money in their pockets. So, where a man sells his claim in that way for $50,000 or $100,000, he should be made to pay a tax to the Government. Besides, very often those men retain an interest in the properties they dispose of.

MR. J. BURLEY SMITH, (Glen Almond, Que.)—I would ask if it is a fact that when the Government grants a mining right, it is done with the idea or intention that the property shall be mined? Otherwise, they could not expect to derive a revenue from the royalty on that mine. If the Government leese lands to people who do not work them, it is quite evident that the law itself is inoperative; but a way to get over that, would be to make a miner take so much land on mining rights conditionally that he should work it, and make him also pay a certain sum for a certain number of years. The miner then knows that if he does not work the land it will not pay him to take it.

MR. R. G. LECKIE, (Londonderry, N.S.)—The Government is willing to dispose of its property at so much per acre. They will take no responsibility in exploring or developing these lands. It leaves that entirely to the purchaser. For instance, I have taken up several square miles of land in Nova Scotia, supposed to be inlaid with coal. We have spent probably fifteen or sixteen thousand dollars upon these lands. The coal supposed to exist here has not been found, and that money invested has practically been lost. The Government will not refund us anything; then we go on again, and purchase or lease other lands; and repeat perhaps, the same thing. If we are not successful, we lose our money; and if successful we ought certainly to have the return sufficient to cover the great risk we run of losing our capital. The Government will risk nothing; but leaves all the expenditure and risk of loss to the miners, or "advanturers", which is the English term.

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## Notes on the Legislation Affecting the Working and Regulation of Mines in Nova Scotia.

MR. H. S. POOLE, (Stellarton).—In Nova Scotia the Provincial Legislature has besides the public weal the interest of a landlord in the minerals to influence the tenor of its Statutes relating to mining. These two interests have had added to them a third, which is political.

The earlier legislation had in view almost exclusively the extension of the industry and the encouragement of capitalists to develop the mineral resources of the province; this is especially noticeable in the debates of 1866 when members on both sides of the house unanimously agreed for these express purposes to grant to lessees the right to have their leases renewed on the same terms, conditions and covenants as contained therein for four periods of twenty years each. The form of lease adopted approximated closely to one very generally employed in Great Britain, and reserved to the landlord the right to inspect the mines and to object to bad practice. This reservation was in conformity with the Mines and Minerals Act which expressed alone, until the year 1873, the desire of the country to foster mining and to control the methods and practices of the miner.

This Act went on to define the terms under which mines and leases of areas could be held and the fees to be paid. A discussion of its requirements and the modifications that have been made to it of late is left to others.* Here it is proposed to alone consider the practical branch, which in the Act in question was limited in Section 5 to the appointment of an Inspector and empowering him to examine and report to the Commissioner of Mines. It imposed but one penalty, forfeiture of lease, for all shortcomings on the part of the lessee, be they great or small; the result was that the Inspector of Mines was practically powerless to enforce any rules that good practice elsewhere commended. The writer realized this in 1872 on his appointment to the office of Inspector, and he then recommended that an Act based on the lately amended English Mines Regulation Act should be introduced, and one somewhat less stringent was with slight amendments passed the following year.

The desirability of such a Regulation Act appeared to be accentuated by the Drummond explosion, with a loss of 59 lives which followed almost immediately and before the Act came into operation. Its stipulations were almost exclusively in favour of life. It began by including all openings for mining purposes as subject to its provisions and then in provisoes made certain exemptions. It divided mines into two sections, metallic and non-metallic:

It defined who were responsible for carrying out its provisions:

It regulated the employment of boys:

It touched on the Check-weighman question:

It required two outlets fitted for the passage of men:

It stipulated for official returns, frequent surveys and reports of accidents:

It empowered inspection:

It provided for Coroner's inquests:

It laid down the well known General Rules:

It furnished a means for supplementing these by Special Rules:

And it imposed penaltics for non-compliance.

The original form remained unchanged for many years and the first amendment of moment had to do with the restriction of operations under the landwash. This was felt necessary in the view of the very large mileage of workable coal that lay off the foreshore of Cape Breton and which can only be ultimately won by reserving access thereto.

When in 1880 the Foord pit explosion with a loss of 43 lives followed an irruption of water which occasioned the loss of other six seemed to call for further legislation, amendments looking to making inquisitions more searching if possible than before were introduced, at the same time the foundation was laid for more frequent inspections, which it may here be mentioned have developed into regular monthly inspections by deputies; the office of Head Inspector being merged with that of Deputy

*The expected papers on the Mines and Minerals Act of Nova Scotia were not read at the Convention.—(EDIT.)

Commissioner of Public Works and Mines an office which alone carries with it a multiplicity of duties.

Authority was also given for the establishment of a Board of Examiners and the granting of certificates of competency to underground officials.* This portion of the Act has been since then expanded, mining schools have been established and facilities furnished in each coal district for aspiring young men to more readily acquire the theoretical knowledge demanded at the examinations. The full benefit expected to result from this step has not yet been felt, the present state being rather one of transition, but the ultimate advantage of having even a rudimentary theoretical knowledge added to the practical work of coal mining cannot be doubted, and the benefits are already most marked.

A minor evil incident to a transition stage is experienced in the tendency of those holding certificates to regard them as credentials of special fitness. This is of course a mistake, a certificate is no guarantee that the holder is a man of tact, of common sense, of resource, is capable of directing men or is in short a good pitman; all it does is to certify that the holder has actually had some practical experience, and possesses some of the qualifications that are desirable for one engaged in the management of a pit. In time however this difficulty should cease and a sufficiently large number of certificated men be available from among whom selections may be made of those possessing, besides a certificate, the more valuable practical qualifications essential to a successful pit manager. In this connection remarks last year by Mr. McKay, Supervisor of Schools, Halifax, on "School Preparation for Industrial Pursuits" are worth repeating:

Of one hundred pupils who enter our common schools, said Mr. McKay, only 33 per cent. complete the sixth grade and 20 per cent. the eighth grade. Nine per cent. enter the academy and four per cent. remain three years. Of ten who enter the academy, one matriculates into college with a view to one or other of the learned professions. The other nine leave with a more positive dislike for manual work than when they left the common school. Some of them will therefore teach, and others will become clerks, bookkepers, etc. Why should education forces and government aid be so largely expended in preparing the few in Latin, so as to enable them to matriculate in medicine, law or teaching, while agriculturists comprising 45 per cent. or the working classes, are left ignorant of the fundamental principles of chemistry, botany and the use of tools? Why are artisans, comprising 28 per cent., left without a knowledge of industrial drawing? These subjects are not only of more importance to these classes than Latin is to professional men but also of more practical utility to all classes and at the same time, in the opinion of educational reformers, better adapted as educational instruments for mental discipline.

Mr. McKay then went on to consider what constituted the best school preparation for industrial pursuits. Seven things, he thought, were necessary: A thorough Kindergarten training; a sound physical education, good health and muscle; a knowledge of reading, writing, and arithmetic; a knowledge of history and economics; a knowledge of the physical, chemical, and physiological forces of the material world; drawing; and manual training. In concluding he reminded his hearers that the literary classes had so far directed education, the industrial classes would do so hereafter.

But to return to our legislation, the intention of the numerous amendments following those of 1881 which related to raising the standard of official knowledge was obviously good, but we as a people have a very general belief that in legislation lies the panacea for almost every ill, and hence it is not uncommon to find Acts drafted by those untrained in legal phraseology and with limited experience, though evidently well meaning, accepted and as freely passed by the Legislature. The statute book is full of Acts hastily prepared and revised in the same laudable spirit, it may be even amended by two and sometimes three separate Acts during the same session. The various attempts to straighten out the clauses relating to certificated officials and their duties are cases in point.

First, the Act of 1881 stated that after a fixed time it shall not be lawful for any one not having a certificate of competency to be employed at any mine in this Province. The time was subsequently fixed for January 1st, 1884, but although there was the Act applying to all mines, gold, coal and iron, and strictly read to all workers in mines, boys and men without exception, no attempt was made to enforce this law. Again there remained for years on the statute book, clause 44, ostensibly framed to reduce the numbers of certificated officials in mines of limited extent, but which actually added to the number of officials required for the class it was intended to relieve, by being made to read "but the operations below ground shall be under the charge of persons holding certificates as underground managers and over-men." Strictly enforced, this, in some cases, would have required four officials at least to supervise the operations of even as few as two working men.

*Chap. v., 1881.

When representations have been made by those whose liberty of action was threatened to be restricted in consequence of the Act bearing a construction beyond that intended, the answer has been good naturedly made, "the intention is evidently otherwise, and an amendment *next* session can correct the ambiguity."

Or again, on complaints that important alterations have been made to the mining Acts without those chiefly affected having an opportunity of studying their bearing prior to their passage through the House, they have called forth the remark, "Oh, the Government cannot prevent any member of the House from bringing in an amendment to any Act." This may be generally true, but as there is a special department devoted to mining matters under the direction of a member of the Government, it has been urged, and it is thought fairly, that all Acts and amendments relating to mines should invariably be Government measures. Not only so, but that no Act should be sprung on the mining community towards the close of a session when it is impossible to carefully consider it, but rather that all Acts relating to mines should be prepared during recess and be subject to the criticism of all classes likely to be affected by them.

The Department of Mines has experienced officers capable of weighing the advantages expected to be gained by any additional legislation, putting on the one hand the restrictions to be imposed and on the other the possible cost to the industry, and the attitude of this Department towards any proposed legislation should be clearly established, as is understood to be the case in England.

Dr. A. R. C. Selwyn, C.M.G., Ottawa, Ont., Director, Geological Survey of Canada.

The strong faith in the efficacy of the mere passage of legislation leads to the assumption that when an amendment to the mining law is proposed it is evidence of its necessity, and our legislators are apt to consider the opposition of mining men to be expected and rather indicative of the necessity than otherwise for the additional restriction. They therefore say let us give the bill a trial, and if it doesn't suit why we can repeal it. As a seafaring people we know the benefit derived from the law requiring masters and mates to hold certificates—let us apply it to our mines as is done in other countries, and not only require the head pitman to hold a certificate, but let us go further and include all deputies, gas triers, shot firers, and even drivers of hoisting engines. This has been done, but the possible combination of circumstances and conditions has not been carefully worked out and made clear in the Act. In its present form, the Act suggests several questions on the intention respecting officials. How many offices can one man fill? Does a certificate of higher grade legalize the holder to perform the offices appertaining to a lower?

Again whether the object of the Act is solely to ensure the employment of suitable men or has it in view to find employment for the greatest number of officials. This question arises when an attempt is made to follow the law in a small mine where the full train of colliery officials contemplated by the Act does not seem warranted. The list of officials besides the owner and agent reads as follows: manager, underground manager, overman, night examiner and shot firer.

It is a grave question whether the advantages expected to accrue from certificating shot firers and firemen such as gas triers and night examiners are not more than met by the disadvantages the complications to which the law in its present shape give rise, and the infractions of the letter of the law when temporary substitutes have unavoidably to be made of non-certificated men. In making appointments for these offices who can know the fitness of men so well as the mine managers? A Board of Examiners certainly cannot. Take the case of a shot firer who must not only know the law relating to firing shots and the use of explosives underground about which he can be examined, but he must know the coal in which the shots are to be fired, how best the shots should be placed, and whether the pickman has "properly worked" the coal for the proposed shot. Especially must he have back bone enough to refuse to fire it when the conditions are not favourable. To judge of this fitness personal knowledge is essential, not mere acquaintance but knowledge of a man at his work, and who has that so well as the manager of the mine? And yet under the law the selection is no longer entrusted to this official of all men the most interested in the appointment of fit persons, but it is subject to the approval of whom? Not even of a Board of Examiners for there is no written examination, but of a local miner, who may not be the holder of an underground manager's certificate of competency.

That this was intentional when the Act was framed is not for a moment suspected and yet it is the result when the law comes to be put in operation. It goes without saying that the management of a mine will appoint the best available men to the permanent positions and the best men for substitutes when such are required. Then again for such an occupation as driving an engine, book learning it has been contended does not add to the efficiency of a man if anything rather the reverse, as it leads to abstraction and inattention to immediate surroundings. And it may be doubted if in this particular case the stipulation requiring a certificate is worth the annoyance it may at times occasion; at any rate in its present form, as no provision has been made for the temporary substitution of uncertificated men during the unavoidable absence of the regular drivers.

One anomaly connected with the law respecting the certification of officials having to do with mines has yet to be mentioned. In the Statutes of 1885 it was required that future Deputy Inspectors of Mines should be holders of certificates to be granted subsequently to examination, but this clause was on a later revision thought to be a mistake and deleted.

Then it would seem, so confident are we in Nova Scotia that the mining world outside our own, which is almost insular, can teach us no new thing, that our legislature has felt justified in emphasizing this feeling and guarding our interests from possible inferior practice and talent, by debarring any one however eminent he may be in his own country from practising here as a Colliery Manager, that is at least, until he has ripened his foreign experience by a three years course with us and obtained a certificate from our Local Board of Examiners.* An exclusiveness that in some branches of trade and art has not elsewhere always led to the most rapid development of a country or the most happy results.

Attention may also be directed to the fatherly regard for colliery boys under 16 years of age, employed not only underground but above ground. No objection can fairly be taken to the restriction of the hours of labour below when the work is regular, but, as the occupations of boys about a colliery above ground are healthy, far more so than those in close factories, and certainly not less so than those about metallic mines, in all cases exempted from the provisions of the law it has been urged that to be consistent the hours of labour of boys in factories and other industries should be also restricted. Until this is done the purity of the sentiment that induced the addition of this clause must be questioned. At the present time it is exceptional to find one among the workmen who is in favour of restricting, especially on the surface, the hours of boys between fourteen and sixteen years of age to 54 hours a week.

It is of course very desirable that the apparent contradictions in the Act should, as far as possible, be eliminated, not an easy thing to do even when the interested parties are agreed, and still less so when there is disagreement and amendments are compromises. Among the changes that might be made, it is desirable that small mines and simply worked mines should not be obliged to employ a greater number of officials than the necessities of each case require, and which would be demanded were it not for the wording of the Act. And that the exceptional requirements of more complex mines

*But an English certificate is accepted in lieu of local experience, still the holder must undergo a local examination.


COUSIN JONATHAN TAKES IN THE RINK.

Being a sketch from life of a member of the American Institute, who basely counterfeited the genial President of the American Institute of Mining Engineers, at the Carnival, Victoria Rink, Montreal, 23rd Feb., 1893.

should be met by additions to the Special Rules as provided by the Act.

It seems desirable that the law should clearly legalize the practice of the manager and the underground manager being one when the duties of offices can be assumed by one person, especially as the definition of the duties attending these two offices draws a distinction with a difference that has yet to be legally defined

It might be well if the definition of "overman" were changed and made to read the officer in charge in the absence of the underground manager

And it would appear more consistent on the part of the Legislature if, for the welfare of the working man he is when engaged at the coal mine to be paid fortnightly, that he should be equally protected as regards the payment of wages when working for large employers of labor.

MR POOLE—I bring forward these notes with the hope that by bringing them to the attention of our own legislature, amendments may be produced I thought it better to take the bull by the horns, to discover whether we are likely to get this legislation or not, and therefore, the Mining Society of Nova Scotia expressed its desire that a representative of the Department of Mines or the Government might attend at this Convention. The Inspector was unable to be present, owing to pressure of business; but the Premier of our province having occasion to come to this part of the world at this time, has most kindly undertaken to appear on this occasion and to profit by this discussion, which it is hoped will take place on this and other matters. Those who know our silver tongued orator can appreciate how venturesome it is of me to speak in his presence, as any one who has passed through the fire of Moloch, in the County of Pictou, can testify.

CAPT. ADAMS—I think that Mr. Poole's able exposition and representation will tend to make us all good anarchists. I have much pleasure in calling upon the Hon Mr Fielding to address the meeting.

HON MR FIELDING—I have the pleasure of knowing a number of the gentlemen present this afternoon, and I trust that they know me well enough to feel that I do not presume to enter upon a discussion of mining laws in the midst of a body of mining gentlemen, the most of whom are ever disposed to think that all mining laws are bad. Far from finding fault with, I welcome Mr. Poole's criticisms most cordially. I congratulate him heartily, and join in expressing my regret that Dr. Gilpin, our Inspector of Mines, has not been able to attend. I do not wish for a moment any one to assume that I am present as a substitute or as a representative of the Government, in any capacity, to discuss mining matters. I had occasion to come this way, and combining pleasure with my business, I accepted the invitation to attend this Convention; and, as the Mayor of Montreal said the other evening, "I am here."

There is a general tendency to grow in this world; and I admit that the laws of some years ago are not good laws now If we are never to have any changes in these matters, I should get along very well; but the public at large seem to think that some legislation is necessary; and naturally we revise these laws when revision is considered essential; though sometimes we do not make them any better than they were before. But the public require that they should be revised all the same.

There is no province in the Dominion in which the mining community have received fairer consideration than the Province of Nova Scotia. We must deal with the truth that in former years laws were moulded at the will of mine owners; but at the present time there is a disposition to recognize that there are more than mine owners to be considered in this matter, and we must speak plainly now The working men in the country have in the past few years made their voice heard and felt in the legislation of Nova Scotia; just as in the legislature of the civilized world; and in the desire to meet their reasonable wishes, some mistakes have been made. There is now in the Parliament of Nova Scotia a representative of the working men who is giving special attention to what he considers their best interests; and some of the legislation complained of by Mr. Poole is attributable to the evidence of that gentleman. It is possible that in his efforts he has asked the attention of the legislature to some measures which were open to debate there; and which other members, not being so well informed on the matter, may not have gone so deeply into. I am willing to learn, and the purpose of my presence here to-day is not to presume to teach this gathering of mining men, even about the mining laws of Nova Scotia

There was a tendency on Mr Poole's part to undervalue the certificates It is quite possible to under estimate; but these certificates should be received broadly. A medical man is not necessarily a man of great skill. He gets his deploma and a big red seal, and he is sent out to cut our leg; if we are fortunate or unfortunate to fall into his hands.

These certificates only prove that a man has received a certain measure of training, and if that man possesses brains and judgment, he should be qualified to do the requisite work Perhaps the strongest point made by Mr. Poole is that all legislation in respect to mines should be brought about, not in a haphazard way, but that it should pass under the view of an officer of the Government of the province. But that is a matter more likely to commend itself to members of the province than our friends of the United States. Perhaps the distinction between the British and American Governments in this matter is that the legislation in British provinces is largely directed by the cabinet, and in many of the most important things the Government assumes the direction and the legislation; and in the main, that has a wholesome effect. But it is quite possible there to overdo things; and the private members in Parliament are disposed perhaps to think that the Government may want to interfere with private liberty with which all Governments should be careful not to interfere. But in the United States you have no Government in Parliament. The Government is *outside* of Parliament, and that is on the floor of Congress. Every member has the same right as his neighbor; every private member has the liberty of introducing a bill upon any subject which is in his judgment for the benefit of the people. With the general tone and temper of Mr Poole's criticism, I have no fault to find. I know he has no object but the improvement and protection of our mining legislation.

I can assure him that when the next session of our legislature comes round, if he and his brother associates in mining will come as in the past and meet the members of the Government, they will find every reasonable proposition they make met in the same spirit which has been manifested in the paper Mr. Poole has read this afternoon.

MR. POOLE—I would add a word or two which I think may be considered due to myself. I did not intend to question the efficiency of the certificates given to men who were examined. I took objection to the granting of certificates without an examination, and the leaving of the decision to men whom I did not consider were quite so competent to judge of a man's fitness as those who were in charge of mines. One word more, I contend that the law of 1872 contained within its provisions that which would have enabled, had it been put into practice, desirable amendments to be made to the Mines Regulation Chapter from time to time, as occasion might seem to require. The propositions I have reference to are the clauses relating to special rules; which clauses, so far as I know, have never been put into practice. I contend that if the workingmen have grievances, they can bring the matter to the Government, and the discussion can follow between the two parties supposed to be interested; with the Government as arbitrator. This I think a better system than bringing the matter on the floor of the House at the busy season of the year, when it cannot be carefully considered. After that, the Act as it stands is quite sufficient to meet all such cases.

MR. CHAS. ARCHIBALD (Gowrie Coal Co., Cow Bay, N.S.)—I regret that I was unable to be present when Mr. Poole began to read his paper, and that consequently I did not hear the whole of it read. But I am very thankful for hearing what I did of it, and for hearing Mr. Fielding's able speech. It was very good of the Premier to tell us that the Government of Nova Scotia would in the future, as in the past, meet the mine operator in a broad spirit; and perhaps after the discussion today, he will be more inclined than ever to do so in regard to these matters. What I want to speak about, is the certificates. The laws are, of course, very good; but we who have to mingle with the men who get these certificates, have an opportunity of knowing what these examinations do for them; and we are perhaps better able to judge than others who know nothing about mining; and though I am very favorably inclined to the idea of educating men up to a standpoint of underground management, I think the province has not done enough towards educating these men. The fault I find is, that in our section of the country (Cape Breton) we find men taken from their places where they have been merely miners, and in very many cases unfit to do any work other than mining; they do not know how to put timber up properly; they know nothing in connection with underground work. Yet these men from advantages in their previous life are able to go to school for perhaps two months, and in certain cases, they are passed by men who never worked in a mine; but they get through and are examined by men who could not pass an examination themselves. Therefore, I say, you cannot expect these men to be fitted for the positions for which they get certificates. However, I have no doubt, when these matters are put before the Government, they will help us out, and I feel sure that the paper read by Mr. Poole will be the means of improving this particular point in connection with mining legislation in the province of Nova Scotia.

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## Notes on the Drummond Colliery, Westville, N.S.

This was the subject of a contribution from Mr. Chas. Fergie, M.E., manager of the Intercolonial Coal Co., at Westville, N.S. Mr. Fergie, owing to illness, did not reach Montreal until the end of the week, and the paper was read in his absence by the Secretary. It was as follows:

This property situated at Westville, in the county of Pictou, Nova Scotia, and owned by the Intercolonial Coal Mining Company of Montreal, has a coal area of 2¾ square miles. The main and second seams are worked, the third and fourth being intact. The second seam is only in process of being opened up, and the following notes refer to the main seam alone, which is worked by slopes, size 12 ft. by 8 ft., having an average dip of 16 degrees, and are 4,200 ft. long; the fan shaft is situated to the south of these slopes at a vertical depth of 70 feet and is 10 ft. by 8 ft. The coal is good for steam and household purposes and makes an excellent coke. The No. 1 slope is used exclusively for hoisting coal, the No. 2 for lowering and raising men, also for dropping down timber, materials, etc.

WINDING.—The winding and hauling engines are set back in direct line with the slopes. No. 1 winding engine has two horizontal cylinders 28 in. x 60 in. x 60 in. stroke; balanced piston valves; pair of plain drums 10 ft. diameter x 3 ft. 6 in. wide with independent action. The Lane friction gear is used; hauls 12 boxes, each containing 1,344 lbs. of coal up 3,700 ft. in 3 minutes.

HAULING ROPES.—These are of plough steel, 1 in. diameter, "Lang's" patent, have been running steadily for 20 months, and are now apparently as good as when put on.

BOXES.—These are of wood, size 4 ft. 2 in. x 2 ft. 2 in. wide by 2 ft. 6 in. deep. The wheels are steel, 12 in. diameter, fast to the axle, which is 1⅝ in. diameter, and also steel; the bearings are inside; the gauge is 2 ft. 8½ in.; 300 boxes are used in and about the mine and the greasing is done on the surface. To avoid waste of oil and grease, and to provide a continuous and sufficient lubrication, a self lubricating pedestal, lately protected by the writer, is being introduced with good results.

NO. 2 WINDING ENGINES are a pair of 16 in. x 36 in., V friction geared 2 to 1; drums 8 ft. diameter; work singly or connected. The rope used is ⅞ in. of crucible steel.

BOILERS.—There are 5 egg-end steel boilers, each 30 ft. x 3 ft. 6 in.; the working pressure of steam is 80 lbs., 2 Cornish steel boilers 30 ft. x 5 ft. 6 in., flues 1 ft. 10 in. diameter, working in conjunction with 1 "Heine" boiler of 200 h. p., the working pressure of these is 100 lbs.; this latter boiler, is a quick generator of steam, accessible at all points, costs little to erect, and will burn the smallest slack or duff. Steam is conveyed down the mine by 5 in. cast iron pipes having spigot and faucet joints, for the first 2,000 ft., afterwards 6 in. wrought iron flanged pipes to a point 3,700 ft. on the slope. The latest pipe provided for the lower workings are 3 in. wrought iron tubing flanged at ends, with loose cast iron spigot and faucet flanges.

PUMPING.—Three steam pumps are employed. No. 1 is "Knowles" direct acting compound plunger pump, cylinders 8 in. and 14 in., plunger 6 in., stroke 24 in.; independent condenser; vertical lift 347 ft., column 10 in. cast iron. No. 2 is a "Northey" improved steam pump cylinder 14 in., plunger 5 in., stroke 12 in. with separate condenser; vertical lift 500 ft., column 4 in. cast iron. No. 3 is also a "Northey," 12 in. cylinder, 4 in. plunger, 12 in. stroke; vertical lift 80 ft., column 3 in. wrought iron.

VENTILATION.—The ventilation of the mine is produced by a fan of the Guibal type, constructed by G. W. Snyder, Pottsville, Pa., and erected July 8th, 1875; it is 20 ft. by 7 ft. wide, driven direct by an engine 16 in. by 24 in.; the engine and fan running at a speed of 45 revolutions per minute produces 100,000 cubic ft. of air per minute, with a gauge of ⅞ in. A steam jet is provided in case of accident to fan, and is capable of producing 25,000 cub. ft. of air per minute.

UNDERGROUND HAULING.—The haulage on the south levels, from which two-thirds or more of the output is taken is by tail-rope; the engines, built at the colliery, a pair of 8½ in. by 6 in. stroke; geared 7 to 1; drums 4 ft. by 2 ft. 6 in. wide; hauls 22 boxes each trip; average speed of boxes 6 miles per hour; rope crucible steel ⅝ in. diameter; boxes run on T rails 18 lbs. to the yard.

COKE OVENS.—There are 20 bee-hive ovens, each 12 ft. diameter by 6 ft. high; a charge consists of 5 tons of unwashed coal, and which has passed through an ½ in. screen; ovens are drawn every 72 hours; average yield of coke is 2 tons 16 cwt. per oven per charge. A "Sheppard deadweight" coal crusher has just been erected, capable of crushing 12 tons per hour; the coke produced from this crushed coal is a great improvement on that previously made, it is stronger, brighter in appearance, more uniform in texture, and has more of a metallic ring when struck. A "Robinson" coal washer is about to be erected, and this is expected to remove a large percentage of dirt in the slack, and consequently reduce the ash in the coke.

LIGHTING.—The work-shops, engine-houses and bank-head are all lighted by the incandescent electric light, supplied from a dynamo, placed in the machine shop, and which is driven by a counter shaft from the shop engine; its capacity is 75 lights of 16 candle power. No open lights are allowed in the mine; the lamps used are the Marsaut and Clanny, the latter one being replaced by the former.

SCREENS.—The ordinary fixed screens are used, arranged to make Round, Run of Mine, Nut and Coking coal. The height of the bank-head is 25 ft. length of screen bars 14 ft. set at an angle of 29 degrees. To avoid breakage, and allow for more thorough picking and cleaning, the coal, after passing over the screen bars, slides on to an apron shewn in fig. 5, where a man in attendance examines it, after which the apron, actuated by the lever shewn in sketch is lowered and the coal allowed to fall gently into the car.

WORKSHOPS.—These consist of a carpenter's blacksmith's, car, machine shops and sawmill. The machine shop contains lathes, drilling and screwing machines, also the dynamo for electric lighting. The sawmill contains travelling rotary saw and cross-cut, drilling, and notching machine for cutting groove in edge-rail sleepers. See fig. 6. This machine will cut and groove 60 sleepers per hour. When formerly cut by hand they were turned out at the rate of 10 per hour per man.

MODE OF WORKING.—The seam is worked on the bord and pillar system; each lift is 450 ft.; the levels are S.E. and N.W. 20 degrees; the dip is 20 degrees on the north and 16 degrees on the south side; counterbalance planes are driven every 450 to 500 ft.; the bords are 12 ft. wide by 9 ft. high on the south, and 10 ft. wide by 7 ft. 6 in. high on the north side; heads are driven every 50 ft., 6 ft. by 6 ft.; the pillars average 50 ft. by 40 ft.;

the roof is left on and no timber, as a rule, is required until the extraction of the pillars. The main levels of every lift are driven out to the extreme boundary before the work of opening out by bords is commenced. The coal is then worked back towards the slopes. No explosive is used, the coal being worked by maul and wedge.

EMPLOYEES.—The average number of persons employed are—underground cutters 176, loaders 24, on cost 70, boys 66, total 336; surface 118 men and boys; total underground and surface 454. The average daily output is 900 tons in summer and 500 tons during winter months when working.

SHIPPING WHARF.—This is situated at Granton, on the Middle River, 7 miles north of the mines, with which it is connected by a line of railway owned and operated by the company, Steamers of 2,600 tonnage can and have loaded here. The quantity shipped over this wharf last year was 100,000 tons. Two locomotives and some 160 hopper cars are employed during the shipping season. The total output for the mine for the year 1892 was a little under 200,000 tons.

TUNNEL FIRE.—A tunnel having a rise of 1 in 160, size 10 ft. by 8 ft., started from the 3,200 ft. level and driven against the measures, S.W. 70 degrees, has just been completed, which intersects the second seam at 1,000 ft.; the strata passed through consists wholly of fire-clay and blue shale. The explosive used in the driving of this tunnel was Roburite, manufactured at Halifax by the Canada Explosive Co., fired by the electric battery. No fire damp was seen until striking the coal by a test bore-hole, about 80 ft. deep; this, however, was not very great, and it was not until the tunnel met the coal that heavy feeders of gas were found. These feeders increased as the seam was opened up, but there being a good ventilation no difficulty was experienced in dealing with the gas and keeping the place clear. Affairs were soon to be changed, for at 6 p.m. on 7th December, 1892, the coal caught fire from a shot. Two shot holes, the on the right, the other on the left, were drilled in the rock. The former was 3 ft. deep and charged with 11 oz. of Roburite, the other 2 ft. 6 in. deep was charged with 8 oz. of the same explosive; both holes were well prepared and tamped and both shots were fired together by the electric battery, which was placed some 185 feet from the face. Simultaneously with the putting in action of the battery a sharp explosion took place, knocking over the men, damaging the ventilating troughs, and putting out all lights. The men after getting out to the main slopes, and procuring fresh lights, returned to the tunnel and endeavored to extinguish the fire, but without avail. The writer was then sent for, and immediately proceeded to the seat of fire, where he was shortly afterwards joined by his deputies and many willing volunteers. The fire by this time had made considerable headway, and the "damp" was back some 90 ft. from the face, beyond which point no lamp would burn. The mine pump was brought into requisition and water conveyed by a 3 in. hose to the fire. The hose, however, would not stand the pressure, and wrought iron tubing was restored to, which fortunately was already laid in the tunnel, and carried to within 100 feet of the face, when the hose was attached. This gave a good supply of water; the flames were after some hours work beaten down, and the fire was believed to be under control, when the nozzle of the hose got stopped up. This having to be taken off and put right, some fifteen minutes cessation of work took place, everything at this point having to be done in the dark as no lamps would burn in the damp. This stoppage proved very disastrous, for no sooner was the hose got to work again than the flames burst out afresh, setting fire to the gas, which had accumulated in the meantime, and causing a second explosion, which acted similar to the first. With the exception of a couple burnt and one slightly hurt, all escaped without injury. An examination of the tunnel afterwards showed that the "damp" was some 300 feet back from the face and that the fire was increasing. The writer then decided to build a dam across the tunnel and flood it. This was commenced at a point 385 feet from the face, not, however, before a third explosion took place, though slighter than the preceding ones. This could not be built up as high as desired in consequence of the damp becoming so strong that men could not work at it. To make doubly sure of extinguishing the fire, and at the same time hermetically sealing the tunnel, a second dam was built 230 feet back from the first and high enough to flood the tunnel to the roof for a considerable distance inside and this proved effectual. The water was allowed to remain in for about ten days, when it was drawn off and the work of opening up proceeded with. This had to be prosecuted very cautiously as a very large volume of fire damp was present, at one time not less than 25,000 cubic feet. After some two weeks work the place was cleaned up, repaired, and the face reached, where it was found a fall of a considerable height up had taken place. The metals from this fall were found to be somewhat warm and caused some uneasiness at first, seeing that so large an amount of fire damp was present. The shale, however, is not bituminous and soon cooled down. No explosive has since been used and some six feet of coal has been bared by mall and wedge. The quantity of gas being given off is very heavy, and it has been decided to let the face stand for a time to allow the gas to drain itself; in the meantime a pair of slants are being driven down from the second seam upper workings, which will meet the tunnel making connection and a good return to the upcast. Since the occurence of the above fire the writer has repeatedly been asked "but is not Roburite flameless?" From his above experience what other reply can he make but no! Not under all conditions. The hole was well prepared and tamped, the charge was fired by electricity and did its work thoroughly, bringing down the rock as desired. That there was both flame and gas present at the same time cannot be denied, but as the writer hopes to have an opportunity of discussing this question at a later date he does not purpose saying anything further on the subject at present more than he has always had the greatest confidence in the explosive, that many thousands of shots have been fired at these mines without showing evidence of flame, and he believes that had the explosive been supplied direct from the works of the Roburite Co., at Gathurst, England, no explosion would have occurred.

## The Phosphate Deposits of the Ottawa District.

DR. R. W. ELLS.—The phosphate deposits of the Ottawa Valley may be arranged under two heads, viz: those which belong to rocks of the Laurentian System, and those which occur within sedimentary fossiliferous strata of Cambrian and Cambro-silurian age. Concerning the latter, but little has been said of late years; but in the earlier reports of the Geological Survey, attention was directed by Dr. T. Sterry Hunt to the presence of phosphatic nodules in the sandstone of the Chazy formation at West Hawkesbury opposite Grenville on the Ottawa River and the opinion was expressed, that if the sandstone in which these nodules are thickly distributed were burned and ground a fine manure for stiff clay soils would be produced. Similar nodules occur at several points along the St. Lawrence below Quebec, but do not appear of such economic importance as those found near the Ottawa.

The discovery of Apatite in the Laurentian rocks of Canada was first made and noted in the vicinity of the Lievre by Lieut. Ingall, in 1829, but beyond the mere mention of its presence, little attention was paid to the subject for nearly a quarter of a century. Dr. T. S. Hunt also directed attention to its occurrence in the Laurentian of North Burgess, Ont., in the report of the Geological Survey for 1847, and pointed out its great economic value as a fertilizing agent. In 1849 50, the presence of phosphate of lime in the Laurentian rocks of the township of Hull, opposite Ottawa, was noted as well also as at Bay St. Paul and Murray Bay on the north side of the St. Lawrence below Quebec. From the economic standpoint however, these lower St. Lawrence deposits have never been made the subject of much study, owing presumably to the greater importance of those found in the Ottawa Valley.

The mining of Canadian apatite may be said to have commenced in Ontario, about thirty years ago the first direct reference to this being found in the pamphlet prepared for the London Exhibition of 1862, by the Geological Survey of Canada, where a brief notice of the apatite deposits of North Elmsley is given. Mining however progressed but slowly in this section; for although the Brockville chemical works were in operation from 1869, and consumed a considerable amount of the output in the manufacture of super-phosphate, the entire production of apatite from the mines of Ontario from 1863 to 1875 averaged little more than 1000 tons per year. This mining was carried on mostly in the form of open cuttings, the deposits where exposed being worked out in shallow pits or trenches, and deep mining was carried on to a very limited extent, the two deepest shafts reaching to a depth of only one hundred and thirty-four feet, and seventy feet respectively. This was on the tenth lot of the sixth concession of North Burgess. Subsequent to 1876 the output for this district slightly increased the quantity extracted between the year 1878 and 1889 as given in the last report of the Geological Survey, both years inclusive, being about 16,000 tons. For the province of Quebec, the first notice of phosphate mining is found in Vennor's report for the Geological Survey for 1873 74; a few tons being taken out in the vicinity of the Little Rapids on the Lièvre in 1871. The growth of the industry steadily increased and in 1877 the total export of apatite from the mines of the province was nearly 3,000 tons. The discovery and opening up of new deposits in Templeton, Buckingham and Portland raised the output rapidly, till, in 1885, the shipments reached a total of 28,535 tons for the Quebec district alone, which amount, has, owing to various causes apparently not been surpassed since that date.

Much has been written concerning the mode of occurrence and the geological relations of the apatite deposits both of Quebec and Ontario by geologists, mining engineers and experts of Canada, the United States and Great Britain, and a great variety of opinions have been put forth by these writers on this subject. Thus some authors contend that the mineral is of organic origin, and urge in support of this view the presence of the ores of iron, graphite, and the peculiar fossil firm *Eozoon Canadense*, found in certain of the Laurentian limestones and regarded by Sir Wm. Dawson, Dr. Hunt, and Dr. Carpenter as representing the earliest known trace of animal life. By others the view is maintained that the apatite has resulted from the action of a solution, bearing fluorine and phosphorus, in what combination it is impossible to say, upon a bed of limestone; and that this solution traversed the main mass and was distributed by means of side fissures, the result of which upon the limestone of the bed, was to convert a portion into fluor-apatite.

By others again the opinion has been stated that the mineral has been "derived principally from the pyroxenite, in which it is generally found, that the pyroxenite itself is probably derived from igneous sources, either as submarine injections while the Laurentian rocks were being formed or as subsequent intrusions, even though presenting much of the aspect of bedded rock."

In Norway, Messrs. Broegger and Reusch have also maintained the eruptive origin of the apatite found in that country in rocks apparently of the same geological horizon as those which contain the mineral in Canada, and the same view as regards the Canadian apatite in the district north of Kingston, Ont., is expressed by Mr. Eugene Coste in the report to the Geological Survey for the year 1887-88. Dr. Selwyn, in a note in Report Progress for 1888-89, p. 93 k., also says "there is absolutely no evidence whatever of the organic origin of apatite, or that the deposits have resulted from ordinary mechanical sedimentation processes; they are clearly connected, for the most part, with the basic eruptions of Archæan date."

The early views as to the structure of the Laurentian rocks regarded them as in great part, made up of altered sedimentary strata. These were found to be penetrated by dykes of trappean and dioritic matter and by masses of syenite, while the areas of pyroxenic rocks and quartz-feldspars which occur at various points were regarded as regularly interbedded portions of a stratified series of gneiss and limestone. Certain areas of anorthositic rocks, often of large extent which occur in connection with the Laurentian, north of Montreal, were regarded as forming the upper member of the Laurentian system and it was supposed that there was a gradual passage downward from this rock into the gneissic portion. The recent work on these rocks, principally by Dr. Adams, now of McGill College, but for some years attached to the staff of the Geological Survey of Canada, has shewn that they are intrusive and more recent than the gneiss and limestone with which they are in contact, since the anorthosite, while some times occurring along the banding of the gneiss, frequently cuts across the strike of both abruptly, and has also produced a manifest alteration of the strata at the line of junction of the two series; in the same way much of the pyroxenic and quartz-feldspar rocks extend in lenticular masses along the planes of stratification of both the limestone and gneiss, and this mode of occurrence has presumably led to the supposition on the part of the earlier observers in this field, that these rocks were also to be considered as integral portions of the altered sedimentary formation of the Laurentian.

But while many of the pyroxenic and quartz-feldspar rocks do assume the aspect of bedded dykes, in other places these rocks unmistakably cut directly across the stratification of the gneiss and associated strata and penetrate the containing beds at all angles after the fashion of true dioritic dykes, and thus they furnish quite conclusive evidence of their igneous and intrusive character. But further at a number of points dykes of pyroxene are intersected by subsequent dykes of quartz-feldspar rock, while both these in turn are cut by more recent intrusions of fine grained and dark trappean rock.

The apatite has been decribed generally as occurring either in the form of beds, by some, or as veins by others, while yet other authors assert that certain of the deposits are in form of beds, and other portions are of the nature of veins. By far the greater part, however, of the statements made on the subject tend to show that, in the opinion of the writers, the deposits occur mostly in direct association with stratified gneiss and limestone, the pyroxenic rocks being regarded as a portion of the gneissformation, while their connection with intrusive igneous rocks is for the most part ignored. They are stated to occur in two ways, viz., in connection with the pyroxenic gneisses or in the crystalline limestone, either in the form of veins or scattered crystals.

In the paper published by Dr. Penrose in 1888, "On the nature and origin of deposits of phosphate of lime," a chapter is devoted to Canadian apatites, which is the result of a somewhat prolonged study of these deposits as they occur in Ontario and Quebec. As to the distribution of the apatite Dr. Penrose remarks that "the mineral occurs almost without exception in association with pyroxenic and horn blende rocks. This rule especially holds true in the Quebec district, where the phosphate has never yet been found without being associated with pyroxene rocks, possibly often of vein origin." He further states that "the pyroxene rock is never found distinctly bedded, though occasionally a series of parallel lines can be traced through it, which while possibly the remains of stratification are probably often joint planes, and sometimes when the pyroxene has been weathered, apparent signs of bedding are brought out, which are often parallel with the bedding of the country rock." And again he says "the gneiss in some places has no distinct line of separation from the pyroxene, but seems to have been impregnated with some of it, forming for a few feet from the line of contact, a more or less pyroxenic gneiss, which is easily decayed and eroded by weathering."

In the report of the Geological Survey for 1863-66, Dr. Hunt discusses the occurrence of apatite in the North Burgess district, and states a number of facts, from which we learn that the mineral occurs there in two ways, viz., first in association with pyroxene, regarded at that time as a form of gneiss belonging to the sedimentary series, in which case it is generally massive; and second, in the form of crystals, often of large size, disseminated through limestone. In this case the deposit frequently takes the form of veins, the associated minerals being pyroxene, mica, sphene, etc. The close relationship of the apatite with the pyroxenic rock is however clearly pointed out and the statement is made that "although not met with in orthoclase gneiss, the presence of apatite seems characteristic of the interstratified pyroxenic rocks of this section, in which it is generally found in small grains and masses, alike in the granular and the micaceous schistose varieties." A number of cases are cited where the mingling of apatite with pyroxene is readily seen, as well as of the association of the apatite with the limestone, in which case also there

is a clear relationship apparent between the two, the pyroxene occurring in the form of dykes or veins which cut the limestone transversely to their strike and in which there is very frequently a mingling of apatite and pyroxene crystals.

In cases where the apatite occurs in the limestone, both in Ontario and Quebec, the crystalline form is the predominent one. Some of these crystals are of very large size, weighing several hundreds of pounds, which are sometimes sufficiently numerous to warrant the investment of capital for their extraction. This form of deposit, however, appears to be more frequent in Ontario than in Quebec, though in the latter province several such mining areas have been worked, more particularly in the country directly east of the Gatineau.

In a report on the North Burgess district by Mr. Vennor to the Geological Survey in 1873 74, a description of a great number of openings is given, from which it is easily seen that the principal deposits in that section occur in connection with the pyroxene bands and he states that, though many openings have been made in the crystalline limestone, the mineral in these cases almost invariably assumes the form of crystals, which, when sufficiently numerous, are of economic importance, but which generally do not compare in value with those in the pyroxene rocks.

In the same report also a brief description is given, for the first time, of the phosphate deposits of the Buckingham area, in which he states that the apatite occurs there in a pyroxenic rock, with which is associated a good deal of orthoclase gneiss; and so strong is the resemblance in some portions of the district between the apatite and the containing rock that some hundreds of tons of the pyroxene were mined by one company under the impression that the rock was phosphate.

The Laurentian rocks of Ontario and Quebec, in addition to the series of limestones and gneisses which make up the bulk of the system, contain also great masses, regarded by most persons who have studied the subject in recent years as of igneous origin, which have been intruded into the mass of the stratified deposits. These intrusive rocks are supposed to represent portions of the original magma or crust of the earth. Among these are great areas of anorthosite already briefly alluded to, in which the prevailing feldspar is of the variety known as labradorite, together with great masses of syenite and granite, diorite, trap, porphyry, pyroxenic and quartz-feldspar rocks. The intrusive character of most of these is seen in their action upon the strata which they penetrate, and in the cutting off or distortion of the mass in contact, or by the generation of crystals of various kinds in the gneiss or limestone or sometimes in the mass of the dyke itself. Some of these intrusions have exercised but little apparent influence upon the occurrence of economic minerals, but in the case of others, notably the dykes of pyroxene and quartz-feldspar, such influence is very marked.

The gneissic portion of the system comprises rocks of various kinds, certain portions being largely quartzose, while others are almost devoid of quartz. Certain bands are black and hornblendiic while others are red from the prevalence of red orthoclase feldspar. Other bands again are highly garnetiferous while at times scales of graphite are so thickly disseminated as to make their extraction and purification a matter of economic importance. In certain areas, bands of limestone, generally of some shade of white or grey, are found and these are occasionally greenish from the presence of serpentine, in which case not unfrequently small veins of asbestus or rather chrysotile occur, which in several localities have been worked to a limited extent.

Over large areas the series as a whole frequently present a well banded or stratified arrangement as if resulting from the alteration of sedimentary deposits. In the areas now regarded as intrusive, while stratification does not appear, a certain foliation is manifest, not only in the syenites and anorthosites but in certain portions of the pyroxenite areas, which structure is however very probably due to pressure during the great period of crumpling to which these rocks have been subjected.

At different points throughout the district north of the Ottawa, more particularly in the area celebrated for the deposits of phosphate and mica, the relations of the several masses of the intrusive rock to the surrounding gneiss can be well studied and in order to depict these more clearly a series of photographs were taken for the Geological Survey of Canada during the past season by Mr. H. N. Topley, which have been colored to show the gneiss, the pyroxene and quartz-feldspar and the apatite.

Among mines thus illustrated are the Little Rapids, the London, the North Star, the Villeneuve, Crown Hill and High Rock in the Lievre district, and the McRae mine in the Township of Templeton.

In the last named mine the pyroxene dyke which carries the apatite cuts directly across the strike of the gneiss, and has been mined out almost entirely for nearly a hundred yards along its course, the sharply defined contact of the edge of the gneissic strata with the mass of the dyke being well exposed. At the Little Rapids mine the pyroxene cuts the stratification of the gneiss at an angle of about thirty degrees, so that in the open cut which is left by the removal of the pyroxene, the edge of the gneiss is also brought into view. At the London mine, the pyroxene for a part of the distance is intruded along the lines of stratification but the contact of the two series of rock is abruptly and clearly defined. At the North Star mine most of the principal openings are in the pyroxene dyke which follows the strike of the gneiss, but at several points in its course the gneiss is thrown out of its regular strike by the agency of the intrusion.

The great dyke at the Villeneuve mica mine consists largely of quartz and feldspar. It has an exposed breadth of about fifty yards and follows closely the stratification of the gneiss, but at several points spurs break into the rock along the contact At Ross Mountain, Crown Hill and High Rock as well as at the mines to the north in the direction of the High Falls the country gneiss which here forms a series of hills from 500 ft to 700 ft above the River Lièvre is intersected by a series of pyroxenic and quartz-feldspar dykes. Some of these apparently run along the lines of stratification of the gneiss, while others break directly or transversely across the gneissic strata; and at many places the different dykes interlace one another in a wonderful manner At Crown Hill the great masses of pyroxene have thrown the gneiss entirely out of its normal strike, while several of the pits show a capping of gneiss above the intrusion. A similar feature of the gneiss and pyroxene is seen at the North Star.

That these masses of pyroxene are deep seated is seen at the High Rock and the North Star workings, at which points the openings at the summits of the hills are at least 600 feet above the river at their base, while the lower workings at the North Star have reached a vertical depth of at least that extent and at the High Rock, the most productive ground at present is from the levels lands near the base of the hill at a depth of over 400 feet from the surface workings. In both these mines which are specially cited as showing the greatest depth of workings, the prospect for successful mining in so far as the quantity of phosphate is concerned is no less satisfactory at the bottom than at the top. In fact in view of the intrusive nature of the apatite-bearing rock it would appear that the old contention put forth by some that the workable deposits were superficial in their character must now be set aside, and it may be regarded as reasonably conclusive that the extraction of this mineral in the pyroxene district will be limited only by the state of the market and the increased cost of mining from greater depths. The peculiar interlacing of the several kinds of dykes is well seen at Crown Hill and High Rock where in one of the pits of the former mine, the pyroxene first cuts the gneiss, and is in turn penetrated by a broad dyke of quartz-feldspar, while both are intersected by a four foot dyke of fine grained black trap-rock. Not only is their intrusive character in this way clearly shown but this view is supported by the presence of various zeolites, and other minerals peculiar to igneous rock, and in crystals of sphene, zircon, mica, &c., near the contact with the gneiss.

In the study of the apatite deposits themselves at many points a feature in regard to their occurrence was noted which is worthy of mention. Thus while the mineral is in places disseminated more or less through the mass of the pyroxene dykes it does not appear in connection with those of quartz-feldspar, with which however mica crystals are frequently found, as in the case of the great dyke at Villeneuve. Further it will be seen from the study of the pyroxene dykes themselves that many of these contain little or no apatite whatsoever, and that in the case of the workable deposits, the mineral is almost always in close proximity to the contact with the gneiss, and this is a point of importance to be observed in the search for as well as the working out of these deposits. At High Rock and the mines in the vicinity where the pyroxene dykes are numerous, masses of gneiss, often of limited extent are held in the pyroxene, but the occurrence of the phosphate in close proximity to the gneiss is seen in nearly every one of the many openings in this district. No deposits of any economic importance have been found in the regularly stratified country gneiss at any point though an occasional crystal, sometimes of large size has been found.

At the North Star mine, in the main pit, which has a depth of over 600 feet, two irregular deposits of apatite are seen in the upper workings. These do not show the structure of regular veins, but, while pursuing an irregularly defined course in the walls of the cut, gradually approach each other as they descend. Ramifying branches are given off from either side of the main deposit and the quantity of the apatite increases or diminishes at various points throughout the extent of the opening; the prospects for successful mining being apparently as good at the bottom of the shaft as at the surface. From the series of openings made on this property, it would appear that the apatite follows a somewhat regular course in the pyroxene near the gneiss, but occurs principally in a series of large bunches or chimneys connected with each other by smaller strings or leaders. Sometimes these pockety bunches of ore are of irregular shape, and yield hundreds of tons, but present none of the characteristics of veins, either in the presence of hanging or foot walls, while many of the masses of apatite appear to be completely isolated in the mass of pyroxene, though possibly there may have been a connection through small fissures, with other deposits The lack of any connection between these massive apatites and the regularly stratified gneiss is evident; and their occurrence in the pyroxene is further evidence in support of the view that these workable deposits are not of organic origin, but confined entirely to igneous rocks.

In certain cases where a supposed true vein structure has been found, such structure can be explained by noticing that the deposits of phosphate occur, for the most part at least, near the line of contact, between the pyroxene and the gneiss. The latter of these, reached in the excavation, has been regarded by the miners as constituting the foot wall, owing largely to the difference in character between it and the rock which carries the apatite, and also to the fact that the occurrence of the mineral ceases when the gneiss is reached. No true hanging wall, in so far as I have been able to study the deposits, has ever been found in connection with the pyroxene-gneiss deposits; but frequently, in the case of dykes of moderate extent, where the gneiss is in contact in both sides of the pyroxene, the apatite is found along both margins of the intrusion. This mode of occurrence also accounts for its continuance along certain regular vein-like lines, since the apatite generally follows closely the course of the dyke.

While as has already been stated igneous and intrusive masses and dykes occur at many places in the Laurentian the area of the pyroxenic apatite bearing rock, is in so far as at present known quite limited; for as in the case of the Eastern Township serpentine, where but a comparatively small portion of the rock is asbestus producing so also much of the pyroxenite is apparently nonproductive of phosphate. This uncertainty as to the extent of any particular deposit should be taken into careful consideration when investigating the merits of a supposed phosphate area, and in some cases doubtless a diamond drill could be advantageously employed.

In regard also to other deposits of the economic minerals found in the Laurentian rock, such as graphite, mica, asbestus, and presumably to some extent at least the iron ores the same association of intrusive dykes is observed. Thus in the asbestus mines of Templeton the asbestus bearing serpentine occurs in a narrow band adjacent to a dyke of whitish crystalline dolomitic looking rock, somewhat calcareous but which on examination apparently possesses the structure and properties of a calcareous pyroxene dyke. In the serpentine near the intrusion, the asbestus occurs mostly in small veins, the fibre varying in length from mere threads to half an inch, though occasionally several of these unite to form a vein of an inch or even sometimes longer. That the serpentinous quality of the limestone, upon which the asbestus depends is due to the action of intrusive rocks would appear from the fact that wherever serpentineous limestone occurs a dyke of diorite, syenite, or quartz-feldspar is in close proximity. So also in the case of the disseminated graphite it is found that near the large deposits or areas of graphitic gneiss, masses of pyroxene or some allied rock occur which have evidently exerted a metamorphic action upon the adjoining strata, while most of the mica deposits occur as crystals either in the mass of the dyke itself, often in this case, a quartz-feldspar or in the gneiss, or limestone near the contact.

From the evidence just presented, regarding the intrusive origin of the pyroxene or apatite-bearing rocks, the question of the formation of these mineral deposits may be briefly discussed. From many analyses, we know that all pyroxenes contain a very considerable amount of calcite, ranging from twenty to nearly thirty per cent. Since, then, the pyroxene in its intrusion with the gneiss must have ascended along lines of fracture or least resistance, it would appear reasonable to infer that vapors charged with phosphoric acid, ascended along such lines, rather than through the mass of the dyke, and that in certain portions in proximity to the margins of the dyke, these vapors impregnated the softened or heated mass, from which, as a result of chemical action upon the calcareous portion, the phosphate of lime was produced. The mineral would, therefore, appear to owe its origin to chemical agency, rather than to organic.

It being six o'clock the meeting adjourned.

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## Evening Session.

On re-assembling Capt. Adams called upon Mr. J. McEvoy of the Geological Survey of Canada, Ottawa, for his paper entitled :—

### Notes on Hydraulic Mining in British Columbia.

MR. JAS. McEVOY.—In the first efforts of the pioneer gold seekers, the gold was extracted from the gravel simply by the use of the pick, shovel and gold pan or rocker. Sometimes a sluice box was added and the "pay dirt" shoveled into it was washed by a stream of water, the heavier materials such as gold and platinum sinking to the bottom were caught and held by the riffles or cross-bars, there placed for that purpose.

This method of course was only applicable to the shallow diggings, and as the greater part of the diggings especially the richer part were deep, operations had to be conducted on a large scale. Accordingly shafts were sunk and tunnels driven to "bed-rock" and the richer gravel was carried to the surface and there washed in a sluice box in the ordinary way. In some cases the material was raised by hand power, but in the larger works steam or water power, (generally the latter) was used. Where tunnels could not be driven to drain the mine, such power was essential to remove the water. The degree of excellence obtained by the miners in manufacturing the machinery for the application of water power, is a matter of suprise, considering the crude nature of the material of which it had to be constructed.

After this manner all the paying creeks discovered were worked, and at the time, by many, they were thought to be worked out; experience showed however, that although most of the gold was confined to the lower gravel a considerable amount was distributed throughout the entire deposit of the creeks. A short statement of the manner in which the placer gold was deposited will explain this.

During the period of erosion, before the glacial period when the creek beds were worn down to the form in which the bed rock lies at present, the particles of gold set free by the grinding action of the boulders, collected

in the bottom and were not carried far on account of their weight Sometimes during this period the course of a stream became diverted to a new direction in which it continued to run, thus leaving an older and a higher channel to one side. The existence of such channels is often a matter of speculation to the miner and the solving of such a question is one of the ways in which a geologist can be of practical assistance. The power which caused this erosion gradually lessens in force and the channel begins to block up and is slowly filled to the height of the terraces now found lining the sides of the valleys. During this second period particles of gold are still being carried downward and are necessarily scattered more or less throughout the deposit. A third or last period is marked by the water again cutting a channel through the deposits of the second period and in a natural way separating the gold therein contained and collecting it at the bottom of the present channel.

The quantity of gold deposited during the second period mentioned is not sufficient to pay the miner operating in any of the ways already mentioned. To separate this gold the Hydraulic system is used which at the same time collects all that was missed by the comparatively incomplete methods previously employed.

All the claims on a creek or part of creek suitable for working by this method are amalgamated and beginning at the bottom the whole creek is washed out. A stream of water brought from wherever attainable, often from a great distance, is under a head of one to two hundred feet directed against the gravel bank which slowly melts under its force. The mouth piece called a "Monitor" is so constructed with a universal joint and counter-balanced as to be easily operated by one man and pointed in any direction. Such a stream is very effective against a gravel bank, large rocks and embedded tree trunks being quickly dislodged. All the water flows off through a flume carrying with it the smaller material and boulders up to 4 or 5 inches in diameter. The larger boulders are removed and piled up on one side. The flume is constructed of boards and is water-tight with the bottom paved with sawn blocks to withstand the great wear and tear of the flowing gravel.

The most difficult problem to be contended with is the disposal of the tailings where the grade of the creek below the place of operation is low, when the flume has to be carried a great distance to a suitable dumping ground. Unless there is a sufficient supply of water the material frequently blocks up in the flume thus necessitating watchmen to keep it clear. Sometimes it is found practicable to bring an additional stream of water into the flume some distance below the place of operation which ensures a safe transfer of all tailings from that point downward.

The gold is caught in the same manner as in the ordinary sluice box by riffles. Where very fine gold exists blankets are placed in the bottom of the flume or sometimes amalgamated plates of mercury. These riffles should be placed at a sufficient distance from the commencement of the flume to allow the gravel to be well washed so that the particles of gold may be well polished before coming in contact with the amalgamated plates. There is no doubt that some fine particles still escape but it is safe to say that this method by far exceeds others in its closer approximation to a complete extraction of the gold.

Many localites in Cariboo have been extensively worked in this manner for years notably Stout's Gulch, Conklin Gulch, Grouse Creek, the hill sides of William's Creek, North Fork of Quesnel River, etc., etc. Many still remain untouched by the Hydraulic System, some have never been "bottomed" even by shaft; notably Slough Creek. All the tributaries of the upper part of this creek paid well, but the presence of "slum" or soft mud in the bottom of the creek prevents the miners reaching the bottom as the mud oozes upward filling the shaft as quickly as it is removed. A company is now beginning operations on this creek with very good prospects of success.

Charters have been issued to work several of the larger creeks by the Hydraulic system or otherwise, but as the grade is generally very low and the bed rock deep, a great expenditure of capital is required before any paying results can be obtained, however; there is little doubt of a rich harvest eventually rewarding the undertakers.

Several machines have been invented for working gravel deposits. Their object being to overcome the difficulty of removing the tailings, and to dispense with the necessity of a large supply of water. Once these machines are in operation, less than ten miner's inches of water suffices.

The tailings are carried up an elevator and piled to one side, drainage thus being only required to remove the water.

During the last few years the Hydraulic system has been applied to the low terraces and river flats along the Fraser river. The gold here is generally confined to one layer of gravel, but the covering is too deep to allow of it being profitably removed by hand. In operating this sort of ground, care should be taken to secure the shortest transfer for the tailings to a dumping ground. This is generally accomplished by working from the river front backward at right angles, across the claim.

Before closing it would be well to pause long enough to consider the ultimate profit or otherwise of such enterprises. As far as the creeks of Cariboo are concerned there is an undoubted benefit with no after bad results but when the terraces of the Fraser river come under consideration, it is not so easy to say so. Unquestionably it is profitable to the owners and also to the country in proportion to the amount of money spent in wages and for supplies. On the other hand if the terraces so worked were suitable for agricultural purposes there is a permanent yearly loss for ever afterward, even if such land required irrigation for where water can be had for hydraulicing it can also be obtained for irrigating purposes. The land worked over by this process is rendered for ever useless as it is covered with bare boulders to a depth of 3 or 4 feet and over. Sometimes in addition to this land being destroyed the tailings instead of being dumped into the river are scattered over other lower terraces or flats thus doubling the damage. This question was for years a matter of litigation in California and was eventually decided against the miners. All such operations being prohibited in future.

DR. RAYMOND—The closing sentence of Mr. McEvoy's paper seems to call upon some of us from the other side of the line to speak; and, as I was United States Commissioner of Mining for a good many years, and have some knowledge of the history of mining in the State of California with regard to the effect of the tailings upon the land, and also the effect of the subsequent action of the land owners upon the owners of the tailings, I will ask the priveilege of being allowed to say a word or two.

In the first place, whatever may have been the wisdom on other grounds of the legislation which took place in California—the litigation and legislation by which hydraulic gold mines of that State have been shut up for a good many years—nobody can deny the unfortunate effect of that legislation in an economic way upon the interests of California. For it had come to pass that just at that time what is known as the silver question had produced, not only in the United States, but in all civilized communities, owing to the relationship of exchange, a very great deal of perplexity and trouble, and the stoppage of hydraulic mines in California just at the time when they would have become and continued until now to be a source of large annual production of gold, aggravated a trouble which was due on the other hand to a very extraordinary increase of silver. By our double action in the States, on the one side by shutting up 10,000,000 of gold per annum, and on the other side by a sort of legislation in regard to silver ores, which stimulated the production of such ores outside the States, and which has in that way established in Mexico, largely with American capital, a capacity only second to that of the United States, we have halved our production of gold; and on the other hand doubled our production of silver. Thus we have in both directions done the utmost we could to aggravate much of the trouble which has afflicted the countries of the world.

Now, as to the wisdom of that legislation in California, taking another standpoint altogether; namely, the standpoint which I have no doubt Mr. McEvoy takes, the interest of the future and permanent value of land. Perhaps I am a little prejudiced against the grangers, but I think that the question, and the answer to it, depend very largely upon another question, namely how much land are your tailings really spoiling, and what is the land worth now, and how much is there left, after you have spoiled it, for the ordinary uses of mankind? In other words, how much land can you give up to the industry of mining gold? We give up land to other industries. We do not insist that persons who have absorbed land by putting brick buildings on it have thereby necessarily injured humanity. Therefore, it is a comparative question; though I grant freely it is a serious matter to hurt agriculture. But the natural law makes agriculture, even if the so-called agriculturist has come and settled in the neighborhood after the nuisance; as was the case in California. We went to California and found gold; and we developed the country which never would have been thought of but for the gold. We began to dig gold, and the grangers who came to settle in the villages and afterwards sued us for damages, came there on purpose to be injured. They were like the virgins in Don Juan, who, Byron tells us, stood around waiting for the ravishing to begin. They—the grangers—could not make anything in farming, but they came there; and that to some extent was the nature of the persecution in California; which ended in shutting [illegible] hydraulic mines. The pretence about the "navigable" rivers I think none of us need discuss. Those of us who have seen the St. Joachim and Sacramento Rivers will agree I think, that the sooner they are made unnavigable the better.

It is a very curious fact all over the world that agriculture fills up the rivers more than mining. As a matter of fact, in some cases in California, we went down to the beds of the rivers and found the nuisance there. It came from the plow of the granger, who, having broken up the surface of the ground, had made it easy for the rains to wash it into the rivers. But that mere injury to navigation was not, after all, everything. It would be dishonest to deny that the serious matter was the covering of arable ground with sandy deposits of tailings which certainly was not arable; and of course, if we had covered it several feet with boulders we would have made the matter still worse. But I take the freedom of saying that I do not think the amount of land injured in hydraulic work by being bared in that way would be a very serious matter. A much more serious matter is the actual disposition of the tailings; and that is an evil on the face of it that goes on for years and years. You may be careful with your tailings. You may build up in the last 30 years strong timber dams, and you pile them up and keep them out of the way. But by and by when you are gone, and the property passes into the hands of another company, and they do not want to repair merely ancient dams; and presently some extraordinary freshet comes along, and then the tailings of a generation go down and spoil a county; and it is a very serious matter, and no light matter to settle where the line should be drawn. These things, I think, settle themselves better then we can settle them by legislation or principles. The case in California is settling itself to-day. Both parties are acting in great harmony, in trying to make the sand pay the expense by putting in dams which will impound the tailings safely that will probably pass by.

There is another fact, namely, that farming people do not find it any use for them to have arable land, and have nobody to eat the products. They have been ruined quite as much as any of us. I have been in county after county in which the closing of the mines has ruined the farmers. This is particularly so in California, as the farmers do not raise great things as in the East, like wheat, but go in for the cultivation of vegetables and garden truck, &c., for sale in the settlements. No customers anywhere in the world are as good as the miners. They will pay almost any price. And so their market is the best market in the West. But there are a great many instances in which the land to be destroyed is not worth enough to worry about. There is a great deal of land yet left on mother earth; and we can spare some for towns and some for universities and some—for hydraulic mining.

MR. MCEVOY—I might say that in British Columbia the situation is peculiar as the amount of agricultural land is small compared with that of California.

In Cariboo we set an example which I think the Americans might follow; as the Government agent there undertakes to extend the bulkheads from time to time to keep the tailings back, as necessity requires.

CAPT. ADAMS—Does Mr. McEvoy know the smallest average yield of gold to the yard from the gravel that can be profitably worked by hydraulic processes?

MR. MCEVOY—Some few cents per yard. I do not remember the exact figures.

DR. RAYMOND—Our average actual hydraulic yield in California runs from 15 to 18 cents in the cubic yard. We think we could handle it at 3 cents. That would not include the cost for the tailings, and bringing water to the proper head. Our hydraulic fields in California are generally surrounded by rock. A great deal of the money has been spent there in rock tunnelling. That costs money, and takes a great deal of time; and many miles of these rock tunnels had not got fairly to work to show what they could do, when the courts shut up the business.

MR. MCEVOY—I do not know of any instance of that sort of mining in British Columbia. I quite admit the force of the argument of the necessity of sacrificing to some extent the future for the development of the present. But I would like to ask if the agricultural products of California do not to-day far exceed the mining products.

DR. RAYMOND—I will say very frankly that the agricultural products of California so far exceed the mining products that they could easily afford to submit to a loss of a certain percentage of the agricultural products for the sake of the mining products. The point is really not that the agricultural products of California are not going to be destroyed or wiped out by the resumption of the hydraulic mining industry, but how much can be given up to mining.

MR. MCEVOY—All lands are the national heritage of mankind and no owner of land has a right to destroy it for any purpose and render it useless to his successors. Agricultural land will go on producing food, which is of a positive value to mankind, while gold is, of itself, no value.

## Apatite Mining in Quebec.

MR. J. BURLEY SMITH (Glen Almond, Que.)—The greater proportion of Apatite mined in Canada has been raised in the Ottawa district of Quebec, and as the geological phenomena of occurrence will no doubt be exhaustively treated by Dr. Ells in his paper at this meeting on the Apatite depostts of the Ottawa district, I propose in that portion of the subject I have taken up to confine myself as much as possible to the commercial and industrial aspect of Apatite mining, describing as briefly as possible the economic value and use of this important mineral and the prospects of the industry generally, especially as affecting the locality in question. The practical questions of searching for, mining and winning the mineral and its preparation for market encroaching on the geological features only where it becomes really necessary to illustrate any point connected with the winning of the ore from the rocks in which it occurs.

To those who may be quite unacquainted with the subject I may state that Apatite is the name of one of the various forms in which phosphate of lime occurs.

It is found in many parts of the world, but no where equal in richness and purity to that variety discovered more than 30 years ago and worked up to the present day in Canada.

The Chemical composition of Apatite is theoretically phosphate of lime 91 to 92, chloride of calcium 0·0 to 0·42, and fluoride of calcium 4·6 to 7·7. It has a specific gravity of 3·16 to 3·25 or about three and a quarter times as heavy as water and its hardness is=5 to 6.

In appearance it is an exceedingly beautiful mineral, semi-transparent and the Canadian varieties are generally of a bright sea green, red, brown, grey and blueish according to the admixture of various substances which enter into its composition.

Its chief economic value is for the phosphoric acid obtained from it and its chief use is in the manufacture of superphosphate fertilizers or plant food used in agriculture to restore to exhausted soils those elements of fertility taken from it by continual croppings.

In the year 1669 Brandt, of Hamburg, discovered phosphorus to be one of the simple elements and in 1769 Scheele discoverad its presence in the bones of men and animals.

It is present in considerable proportion in plants and the agricultural chemist of to-day is able to state the exact amount found in the various roots and plants which go to make up the food supply of the world.

Phosphorous in the shape of phosphoric acid is therefore an important factor in the economy of plant and animal life.

It is absorbed as food by the roots of plants of which it forms one of the principal inorganic constituents. The plants become the food of the animal kingdom where it chiefly enters into the formation of bone and tissue and is again in the natural order of things restored to the soil as an original element of its fertility insuring a constant reproduction.

But in the artificial state of things now existing, with a dense population closely packed on small areas and far distant from the source of its food supply, these elements are not restored to the soil but are from sanitary reasons chiefly allowed to run to waste with no better result than the pollution of our rivers and streams.

Monsieur Grandeau estimated some time ago that one year's crop in France represents 298,200 tons of phosphoric acid of which only 151,200 tons of phosphoric acid were recoverable in the stable dung, thus leaving a deficit of 147,000 tons of phosphoric acid, equal to over one million tons of superphosphate, to be made good by other means.

He also estimated that the entire number of farm animals in France in 1882, representing a live weight of 6,240,430 tons, had accumulated from their food 193,453 tons of mineral matter containing 76,820 tons of phosphoric acid.

When it is considered that this condition of things is going on in all the densely populated countries of the world, and how much phosphorous must be extracted from the soil every year to make the bones and tissues of animal life, it will be seen how necessary it is that at least as much phosphorus should be returned to the soil as is taken out of it, otherwise it will become utterly worn out and unproductive.

In the early efforts to make up the deficit, bones were used on account of the large amount of phosphoric acid contained, and were indeed the first source of supply for the manufacture of artificial manures.

From the respect we all have for the memories of our deceased friends and our desire that their bones should rest in peace, we can feelingly realize that this source of supply is inadequate to meet the deficit.

Professor Liebig once wrote the following warning: "England is robbing all other countries of the conditions of their fertility; already, in her eagerness for bones, she has turned up the battlefields of Leipsic, of Waterloo and the Crimea; already from the catacombs of Sicily she has carried away the skeletons of many successive generations. Annually she removes from the shores of other countries to her own the manurial equivalent of three millions and a half of men; whom she takes from us the means of supporting, and squanders down her sewers to the sea. Like a vampire she hangs upon the neck of Europe, nay of the world, and sucks the heart blood from nations without a thought of justice towards them, without a shadow of lasting advantage for herself."

Notwithstanding this touching lament it was Prof. Liebig himself who first suggested the treatment of bones with sulphuric acid and thus started the scientific manufacture of artificial manures in Europe.

It is stated that as early as 1822 England imported over 30,000 tons of bones from Germany, and it is known that in recent years she has imported from various sources as much as from 70,000 to 100,000 tons a year.

There are of course many other sources of supply of phosphoric acid for agricultural uses, the most important of which has been guano. Since its discovery fifty years ago, as much as 400,000 tons has been shipped annually.

But it can easily be recognized that these sources of supply will rapidly become exhausted.

Basic slag is also largely used as a phosphatic manure in Germany, 30,000 tons having been used in one year.

None of these sources, however, are likely to supply the ever increasing demand for phosphatic manures, and it is to the practically inexhaustible deposits of mineral phosphates that agriculturists are to look for their permanent supply.

Fortunately for agriculture, though perhaps not so fortunately for the Canadian phosphate industry, mineral phosphates are found almost everywhere and frequently in enormous quantities.

The constantly increasing demand for super-phosphates has not had the prosperous influence on the Canadian Apatite industry which might at first sight have been expected.

If Canada was the only place where the mineral existed undoubtedly both owner of mineral lands and the capitalist adventurers would have had very fine times indeed. It is however, found in its different varieties in many parts of the world, and the increasing demand naturally led to more energetic search and exploitation, with the result of excess of supply over demand and the phosphate market has been flooded. The reckless speculation in some countries and the keen competition to raise large quantities of ore regardless of cost, not merely to supply the demand, but to boom the mineral lands for sale has unsettled the market altogether. Prices have gone down enormously, partly because of excess of production, but chiefly, I think, because the manufacturers do not know to what extent this excess may reach, and whether it may not for many years exceed the regular demand in spite of the enormously increased use of superphosphate which is certain to follow in new countries and old, as the new land of the former becomes as impoverished as the latter, and the agriculturists of both become more scientific from sheer necessity.

It cannot be denied that there is at the present time a most serious crisis in the Apatite industry of Canada. In spite of the enormous increase in the supply of mineral phosphates from all parts of the known world, the Canadian Apatite has continued to hold its own up till now, partly because of the extreme purity and richness of the ore, and partly because the output is comparatively small. The shipments of Canadian phosphate have not exceeded an average of 20,000 tons annually, during the last ten years, whilst other countries have figured up to hundreds of thousands of tons, and there has been little difficulty in placing her small output at remunerative prices while they were high, but now she stands face to face with keen competition and very low prices.

From the high character of the mineral it is considered a valuable material in the manufacture of superphosphate, it yields a higher percentage of phosphoric acid soluble in water than any other raw phosphate material. It is much easier to grind than any other variety of mineral phosphate.

The mineral is practically inexhaustible in quantity, and the recent evidence of Dr. Ells, Mr. Eugene Coste, Mr. Ingall and other scientific geologists goes far to show that the present shallow surface pits and even the deepest one of 600 ft. (at North Star mines) are but mere burrowings compared to the almost limitless depths in which these rich deposits may be lurking, and who can define their magnitude and purity under these conditions. But it is difficult and costly under any circumstances to mine, and it is only by patient scientific and systematic working, that these mines can be profitably carried on in the future.

It depends therefore, in a great measure upon the present attitude of the owners of mining land and the capitalists who have already invested large sums of money in the exploitation, whether the industry is to die out or become one of vast importance.

Prices are very low now and I do not see any prospect of a permanent rise for some years to come and we may be quite sure that the old high prices are not ever likely to occur again.

The characteristics of the deposits of phosphate of lime of other countries and the methods applicable to working them go at the same time to show that prices are not likely to be any lower than at present and what we miners have to do now is to try and "cut our coat according to our cloth," and see if by better and more economical methods of working we cannot mine and ship phosphate to meet the present prices.

High prices for both high and low grade ores have resulted in careless hand to mouth ways of mining.

The ore from its bright and attractive appearance and its beautiful crystals and color so distinctly in contrast to the rocks in which it occurs was easily discoverable. It was indeed found by accident and was known to lumbermen and backwoodsmen by sight long before its value as a commercial commodity became known. A demand sprang up for it and the farmers and settlers commenced to dig and quarry it from the surface "shows," as they are locally called.

The vast volume of rock known by the name of the Laurentian formation in which the Apatite occurs runs from north-west to south-east through the Provinces of Ontario and Quebec, and is characterized by the bold outline of its synclinal troughs and anticlinal ridges and it is when the ridges of gneiss, with its overlying limestone come to the surface that the Apatite deposits have been principally discovered and worked.

The Apatite "shows" are sometimes found as superficial deposits in hollows of the rock, oftentimes covering large areas showing something of the appearance of beds but being mixed with the partially decomposed portions of the rocks in which the phosphate is found and being more especially degraded by the decomposition of the pyrites, which is one of the most objectionable features these bonanzas are not always so valuable as would at first sight appear from their accessibility.

They have on the contrary but too often led to the squandering of vast sums of money in the indiscriminate digging of useless holes all over the property in the search for similar deposits, rarely with success, without serving as a guide in any way as to the true method of occurrence.

Local prospectors have been employed by speculators to uncover and lay bare to the sight these attractive shows, maps have been made by irresponsible experts and illuminated with dubs and splashes of emerald green or red covering acres of ground, regardless of scale.

The very name of Apatite has been used to account for the apparent want of order and system.

Even practical miners and experenced mining engineers have been misled by the indisputable fact of having placed before their very eyes large uncovered surfaces of the mineral, often mere crusts of a few inches thick. No one can walk over the estates of some of the mines now properly developed without observing what large sums of money have been spent in sinking holes which have yielded nothing and proved nothing.

The earnest attention of scientific geologists has however recently been attracted to the subject and the result of their patient investigation proves that the occurrence of Apatite is systematic and orderly like all things in nature and will be of immense advantage to miners in the future by showing how the mineral lies and how it should be sought for. Occasionally these surface "shows" have led down immediately to large pockets or bunches of very high grade ore from which many thousands of tons have been raised but this is exceptional and the miner who follows this plan is only too likely to sink a great number of dead holes.

They are, however, clearly the indication of leads or deposits in the neighborhood and if rightly followed up in logical sequence in prospecting the intelligent miner will be able to accurately locate the position and direction of the pyroxene dykes in which the real and permanent deposits occur.

Sometimes the shows appear on the surface like the outcrops of true but irregular fissure veins, having clearly defined hanging and footwalls, and have been followed down to a considerable depth showing also a more or less regular continuity of direction.

Again they are found in bunches like pipe or pot veins.

But in whatever variety, except the surface bed shows, in which case the Apatite is mixed with fragments of gneiss, pyroxene pink calcite, feldspar etc., very frequently containing a number of apatite and pyroxene crystals and earthy impurities forming a debris, which is evidently the result of decomposition or weathering of the exposed portions of the upturned edges of the rocks which has most likely been washed or rolled away in the course of time from their original locality, they are always found at or near the point of contact of the pyroxene with the gneiss.

Whatever may have been the origin of the Apatite and how it came there there is no question that the ore is found only in and accompanying the pyroxene which according to the opinion of the best authorities are immense dykes intruding through the stratified gneiss to the surface not always, however, coming quite to the surface but sometimes covered with a cap rock.

Experience shows that it is useless to look for Apetite away from these conditions.

The deposits having the appearance and many marked characteristics of pockety, veins cannot be called true fissure veins but having these characteristics they can and should be sought and mined for on a system applicable to vein mining. They have often walls corresponding to the foot and hanging walls of true fissure veins. Their direction is not uniform but generally N.E. S.W. varying some degrees, but a group of these deposits appear to always run parrallel to the same axis, having also the same inclination and though the so-called veins may alternate from wide bunches to tiny thin strings they never quite give out and may sometimes be traced for a very long distance.

Again they are traversed by dykes of evidently much more recent intrusion than the pyroxene dykes cutting right up through them to the surface where they present the appearance of hogsbacks. At these points the vein like deposits are thrown to one side or the other forming, as it were cross courses, often widening out at the junction into considerable pockets. Perhaps the strongest feature is that the so-called vein will often continue to follow the face of the cross dyke for a considerable distance laterally and frequently right up to the surface. I am quite unable to account for this unless it has been by the refusion caused by the igneous effect of the last intrusion. The great number of apatite and pyroxene crystals near the surface strongly favouring this view together with the burnt appearance of the rocks at the surface.

In following the lead it is not "struck out" or lost but continues on the other side of the dyke under the same conditions though thrown to right or left as the case may be.

At or near the junction at the surface irregular pockets of considerable size are often found in the burnt rock, containing ore of very high grade though often discoloured and degraded by admixture with the decomposed pyrites, etc.

In some cases as in the celebrated Emerald mine on the River Du Lievre, and the Squaw Hill mine adjoining, four or five of these so-called veins occur, having all the characteristics I have described. The dyke cuts across on the Emerald property and the leads are thrown but continue again on the other side of the dyke, retaining with singular regularity the distance between them in parallel. On the Emerald side the pocket called the "big Murray pit" occurs, from which thousands of tons of ore have been raised, and on the other side the almost equally celebrated Grant pit occurs, which appears to be on the same lead, allowing for alteration caused by the throw. Owing to the rugged character of the ground on the surface and the dumps surrounding the workings, it might not at first sight be noticeable, but from an actual survey made, both of the surface and the underground workings, these leads are found to be almost parallel running in the same line of direction on both properties, viz.. N.E.-S.W. On the Emerald side of the dyke the veins are five in number, and on the Squaw Hill side four showing that there is still one undiscovered on the latter, although since the survey was made certain indications of the fifth have been found which point to its exact and regular occurrence.

Now from the general appearance of the surface and underground workings of all the mines I have visited in the Ottawa district, the same characteristics are traceable in all, and there is clear evidence to show that if all the mines of Quebec and Ontario, those fully developed and those yet only in the prospecting stage, were properly surveyed and carefully plotted, the result would prove that the uncertainty of the occurrence of Apatite has not been established by the collateral evidence of scientific geologists, but is rather the result of the fragmental and crude experience of isolated prospectors and miners operating over a very large area, forming strange and mythic reasons to account for something they could not not be expected to understand or explain.

Geologists cannot afford to be dogmatic, but the exhaustive reports and essays of these geologists of Canada who have spent so much time in patiently investigating

the subject appear to agree generally in their deductions, at any rate within recent years, and seem to prove conclusively that there is no very great uncertainty in the mode of occurrence of this mineral if properly approached, and that starting from the gathered facts and experience already laid open to him, the explorer may find it easily and with certainty, and mine it with the economy which can only result from knowing definitely how and where to begin and how to work it when found.

The improved geological maps which are sure to be the outcome of these researches will be of the greatest use to Apatite miners in the future as they will show more or less definitely the position and composition of the zone in which they have to work.

The colored photographs of Dr. Ells, showing the position of the pyroxene dykes and the occurrence of the Apatite in them are of the utmost importance to the miner who may at a glance ascertain more than pages of written explanation could give him. On commencing to work a new property the miner should make himself thoroughly acquainted with the rocks in which he has to mine, firstly by reading the results of the investigations of those who have made a study of the matter for years, and by a careful examination of the speciments in the magnificent collection in the museum of the Geological Survey at Ottawa. He should then visit the other mines in operation in his neighborhood and see what has already been done—not necessarily for imitation.

Having made himself thoroughly acquainted with these he should carefully prospect and survey his own ground, making only such preliminary shallow trial pits and costeenings as are necessary to establish the position of his mineral ground which will be found usually to occupy a small area compared to the vast volume of barren rock composing the general area of his property.

The position and run of this can best be ascertained by baring the rocks at or near the occurrence of the pyroxene, in the neighborhood usually of the easily seen surface shows—carefully avoiding undue disturbance of the natural appearance of the surface of the rock by blasting if possible.

The small trial pits and trenches should as he proceeds of course be marked down on his plan. From the comparative position of all those which show phosphate, or indications, he will find that there is a logical sequence of direction, and his previously acquired knowledge of the rocks themselves will enable him to locate the zone in which he has to operate.

He should above all things avoid the unnecessary sinking of big and deep shafts wherever phosphate shows may be found as has been the old custom, in the effort to raise a large quantity of phosphate immediately. It is only in very rare instances indeed that these costly shafts sunk down to follow shows have ever proved successful.

Mining companies have themselves been responsible for much of this wasteful kind of work by expecting their agents to begin and raise an immediate output the first year equal to that of the annual output of the best known and successful mines.

They themselves having been probably misled by the reports of these experts who have too frequently glowingly described them after only a hasty and superficial examination.

Mining for Apatite requires as much skill as any other mineral of equally difficult occurrence and it is better for the manager or agent to spend twelve months or more in correctly locating his mineral ground and developing it with a view to the future regular output rather than to immediate returns.

Having located his mineral ground his technical knowledge, no matter in what kind of mining it has been gained, will then enable him to estimate the amount of development work to be done and the machinery and tools most adapted to be purchased for his work; and still better, he will be able to consider and estimate more accurately whether or not the prospects of his mineral ground are sufficiently promising to warrant the expenditure of his company's capital in permanent development work at all. In some cases it will be found that it is better to abandon his ground altogether at once and seek a new one.

Whereas had he adopted the old custom the capital of his company would at this stage have been considerably expended in costly shafts, etc., without proving anything more.

The writer's own experience is that the sinking of one deep shaft in properly located mineral ground is a better test of the whole property than half a dozen shallow ones put down at once and almost at random and before the agent could possibly have really understood his ground.

As it has been shown by experience that the largest deposits of Apatite occur at or near the cross dykes and may be reasonably inferred to continue so in depth, it may be assumed that no better spot could be selected at which to sink the shaft, keeping far enough away from the dyke to avoid striking its wedge-like angle at some depth down, and having to sink for the rest of the distance in the extremely hard rock of which these dykes are composed.

It is well to commence the shaft vertically if it is intended to be a permanent one and carried to a great depth, because it is more economical in the regular workings afterwards, for well known reasons—making cross-cuts at intervals to test the country rock.

A diamond prospecting drill bringing out cores is very useful for testing the ground as the shafts descend.

But if the lead has a considerable inclination, it is desirable and more economical to sink the shaft in the lead and at the same ascertained angle, because it would then be sunk in the pyroxene which is a comparatively soft rock and it would take in all the phosphate bunches which might occur and a more or less quantity of the ore might be raised, though unless these are very large it is not very profitable, as the ore is very much mixed with the debris of the shaft sinking.

In either case suitable provisions should be made in sinking the shaft for making galleries or drifts at intervals for testing the extent of the lead right and left, and for crossing into other paralell leads—and for permanent drifting and stoping should the ground prove rich. I may here state that phosphate lends itself very well to the operation of overhead stoping, and by an arrangement of head stalls the mineral may often be obtained very pure and unmixed.

If it is determined to sink a permanent shaft it is always advisable to erect proper buildings and machinery at the pit-top at the very beginning, because the economy and speed in sinking a shaft depends very much on the proper arrangement of air compressors, rock drilling, hoisting and pumping machinery.

In commencing a permanent shaft, consideration should be given to the question of fuel and water required for boilers and machinery used. If there is any water power in the neighborhood advantage should be taken of it, even if at a considerable distance away—the cost of long transmission pipes and loss in transmission not being of such importance as the permanent purchasing of fuel and its haulage up to the boilers for steam power.

*Cobbing and Separating the Ore.*—The old plan of breaking off the ore from the pyroxene and other impurities with hammers and the usual picking and screening is perhaps the most unsatisfactory and costly part of the whole question of winning the ore. It is an utterly crude and ill adapted method and until a mechanical method is worked out by which the ore can be separated and classified there is little prospect of phosphates being prepared cheaply enough to meet the requirements of low market prices, or even the rise which we hope for and anticipate.

The hitherto imperfect separation cannot better be shown than by the fact that while theorectically apatite contains 91 to 92 per cent of phosphate of lime, the highest grade of that now prepared for market does not exceed 80 to 86 per cent at the outside, while the second or lower grade does not exceed 65 to 70 per cent.

On account of the vein stuff and the composition of the impurities found mixed with the ore itself being almost alike in specific gravity it is a most difficult matter to achieve a satisfactory separation by mechanical means.

The writer has himself given special attention to this subject and has made innumerable experiments but with indifferent success.

It is however, a point well worth the consideration of manufacturers of classifying and separating machinery, who do not appear to have devoted much of their skill hitherto to the separation of mineralized phosphate.

In conclusion I would say that it is impossible to do more than give a general sketch of the apatite industry in such a paper as this but I trust that what I have said may elicit the views and opinions of some at least of the eminent geologists and mining engineers present here to-day on a subject which all will acknowledge to be of very great importance to the Province of Quebec.

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CAPT. ADAMS—This paper, in conjunction with Dr. Ells' paper read this afternoon, gives us a very full insight into this subject Does any gentlemen desire to make any remarks upon it?

MR. LEOFRED, (Quebec)—What is the price at which the phosphate can be produced per ton?

MR. J. BURLEY SMITH—I cannot say exactly; but from actual account of the whole thing, and having reached a fairly workable deposit, I have found it cost about seven dollars and twenty cents, say, roughly $7 a ton, having gone through the preliminary expenses of making cross-cuts, shafts, &c. This would be for two grades of ore, 85 to 86 per cent, and between 70 and 80. However, it may cost $10, $15, or $20, or even $30 a ton; and, as Capt. Adams said, it might cost from 50 cents to $1,000 a ton. But I think that if it can be put on the railway at $7 a ton it will pay.

MR. MERRITT—I would like to ask, in view of the statement contained in Mr. Smith's valuable paper with regard to Apatite always being present in the pyroxene belts, in which it was said it had been brought up—how is its occurrence in great numbers of crystals explained, and also its occurrence in gneiss? Because in my experience, which is not of course as great as that of many gentlemen here in actual working properties, but in examining them, I have found that if there is anything in creation that appears to be regular, it is the occurrence of Apatite. And further in regard to the occurrence in pyroxene belts, while acknowledging that it is nearly always found associated with pyroxene ore deposits, how can it be explained where Apatite is found entirely embedded in the calcite and also where you find it in pure gneiss existing in a gneissic formation with the gneiss? I would like to ask these questions, because it would be of interest to me to know if that has been investigated in connection with the pyroxene occurrences.

MR. BURLEY SMITH—I may say from my experience that I have never found it imbedded in bunches or any other form whatever in the gneiss.

MR. MERRITT—I have seen in the Kingston district near Otty Lake what I class as gneiss, strings of phosphate occurring in a gneissic form with it.

DR. ELLS—I may say I have yet to find any case where gneiss itself contains Apatite, even in the Kingston or Quebec district. In the Kingston district, it occurs in limestone in the shape of detached crystals; but in no case except in connection with pyroxene dyke.

CAPT. PENHALE—I have listened to Mr. Smith's paper with interest. But I think the question the gentleman on my left, Mr. Leofred, asked Mr. Smith was a very pertinent one: namely, what the price per ton would be. Mr. Smith got over that question capitally; but it occurs to me that the price of mining this phosphate is regulated by the same consideration that enters into the the cost of mining other ores—that is, the nature of the bed of ore we have in the mine.

CAPT. ADAMS.—I have had fourteen years experience in phosphate; and I have learned that the cost may be stated, as I have said already, to be from fifty cents to $1,000 a ton. I am glad to see we have with us Dr. Robt. Bell, of the Geological Survey, of Ottawa. Perhaps he has something to say on the matter?

DR. BELL.—I have nothing to say except that I should like to hear Mr. Merritt's question answered, to give us a rule by which we can find profitable deposits of Apatite. I would say thaat lthough I have never seen Apatite in large quantities in gneiss, there is scarcely ever a microscopic slide of gneiss made which does not show it in the minutest quantities.

MR. F. C. SMOCK (New Jersey).—I might say that Apatite was mined many years ago to a small extent in Hurdtown, N. J., occurring in gneiss. It also occurs in a sedimentary form associated with magnetite near Dover, N. J., and in the well known occurrence of Apatite and Magnetite of Port Henry, N.Y. These occurrence of Apatite in true gneiss in the United States go to show, it seems to me, that perhaps we should not form too positive a rule in regard to the occurrence of Apatite in gneiss rocks.

DR. ELLS.—Might I ask what sort of gneiss this is?

MR. SMOCK.—It is orthoclase gneiss.

MR. MERRITT.—If my memory serves me right, it was orthoclase gneiss, but not in workable quanties. And I asked how this was explained in the crystals in the calcite; and not in workable quantities, as might have heen inferred.

CAPT. ADAMS.—We are told by the scholars that the word Apatite comes from a Greek word, meaning to deceive, and I think it is well deserved.

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## The Electrolytic Extraction of Metals from their Ores.

MR. W. T. GIBBS (Ottawa).—We do not intend in this paper to refer particularly to any special Electrolytic process, but merely to indicate in a general manner the advances that have recently been made in Electro-Metallurgy.

More experiments have probably been made in the last few years on the Electrolytic extraction of Aluminium than on that of any other metal. In spite of the fact that articles are constantly appearing giving particulars of new processes for the extraction of Aluminium, we have yet to learn that any of them are successful even as experiments, to say nothing of their commercial aspects.

We have made a very large number of tests both with alkaline and acid solutions of Aluminium salts; but in no case did we succeed in obtaining a deposit of the metal, and we think we are perfectly safe in stating that so far no method has been devised for depositing Aluminium from aqueous solutions of its salts.

The extraction of Aluminium by the use of the Cowles and similar Electrical furnaces cannot properly be called an Electrolytic process, for the reduction of the metal is probably due to the intense heat generated, and not to any specific electrical action.

The electrolytic extraction of copper is fast developing into a great industry and the next few years will undoubtedly see a contest between the furnace and electrolytic systems, in which the latter will surely be victorious wherever natural forces can be used as a source of power.

The process which seems to be based upon the best principles is one recently introduced by Hoepfner. In it a solution of cuprous chloride is submitted to electrolysis until one half of the dissolved copper is deposited. The remaining half is then present as cupric chloride and the solution containing this is run on to the finely pulverised copper ore, which has been placed in a series of led-lined vats. By a simple reaction more copper is taken into solution, cuprous chloride being reproduced; which by electrolysis is again deprived of half its copper. By repeating this cycle of operations it is evident that the whole of the copper is removed from the ore, and is ultimately deposited on the cathode in a state of high purity.

One of the most important points in Hoepfner's process is the use of ferro-silicon as an anode, which is claimed not to be acted upon by nascent chlorine. Such an anode will do more to advance the electro-metallurgy of copper than any other improvement; for hitherto the trouble has been that the anodes used were always attacked by the chlorine evolved during electrolysis.

Several other processes have been suggested and tried; based mainly on the electrolysis of solutions of cupric salts; but it naturally appears that the ultimately successful plant will be one in which a cuprous salt is used; since the same quantity of electricity will deposit twice the amount of metal from such a solution as from one in which the copper is in the higher state of oxidation.

There is a large field for electrolytic separation in the treatment of the nickel copper ores of the Sudbury district, but so far attention seems to have been devoted chiefly to furnace methods of refining. There is no doubt, however,

that it is possible to refine the nickel-copper matte by electrolysis.

The first step in such a process would be to find an electrolyte which would be practically without action on nickel, and yet attack copper and dissolve it completely. The matte could be cast into plates and used as anodes in such an electrolyte. After the copper had been removed the anode could be recast and the nickel removed by treatment in one of the many nickel plating solutions.

It would seem to be very doubtful if it would be possible to treat the raw ore, without first roasting and reducing to a matte. The percentage of copper and nickel in the ore is so low compared to the amount of iron present that the solutions used would quickly become charged with iron, and it would therefore be impossible to deposit either pure copper or nickel, but in treating a matte this difficulty is reduced to a minimum.

Experiments have shown us that it is quite possible to remove the whole of the copper from a copper-nickel matte by careful attention to the composition of the electrolyte and the current pressure, and this without any appreciable action on the nickel present. The separation of the nickel from the remaining impurities is a more difficult matter, for the reason that the solution used attacks iron freely and the bath in a short time has to be renewed or freed from iron by precipitation.

We obtained some very complete separations by using a strongly acid solution as an electrolyte, and keeping it saturated with sulphuretted hydrogen.

In this way the copper was prevented from going into solution, whilst the nickel was completely separated, but here again we were troubled by the iron going into solution.

The only feasible method will doubtless have to be based on the preliminary removal of the copper and the after deposition of the nickel from the residue.

Another matter of great interest at the present time is the Electrolytic treatment of silver lead ores; atlhough up to the present time very little seems to have been done in this direction.

In the Kootenay district water powers are abundant; electricity can be produced at a merely nominal cost, and the expense of maintaining and running an Electrolytic plant is far less than that of a furnace of the same capacity as is shown by the enormous development in electrolytic copper refining.

In depositing lead the greatest difficulty met with is its tendency to form trees or excrescences on the cathode; and it appears to be impossible to entirely prevent this, although by careful manipulation it may be kept within bounds to a certain extent.

Another difficulty is the tendency to the formation of a film of peroxide of lead on the anode, and thus preventing the solvent action of the electrolyte; but this is much more easily obviated than is the first mentioned trouble.

Not a few attempts have been made to refine base bullion by electrolysis, but so far as we are aware none are in successful operation.

For such a process to be of any practical value it appears to us that it should be capable of taking the raw ores and treating it directly in the electrolytic cells, without intermediate reduction in a furnace.

With copper-nickel ores we do not think such a course possible, for reasons already given; but in dealing with a practically pure sulphide of lead, or of lead and silver, the question of impurities does not arise.

Some experiments which we have made on the Electrolytic treatment of raw galena have been fairly successful.

The ore is finely pulverized and laid on a carbon plate which forms the positive pole, and at the same time, the bottom of the electrolytic cell.

The Electrolyte used was a saturated solution of nitrate of lead in sodium acetate, used at a temperature of 40° to 50° centigrade.

The cathode used was a plate of iron, suspended horizontally over the anode, the lead being deposited on the lower side of it. At first it seemed as though it would be impossible to obtain a satisfactory result, for the lead came down in spongy flakes, and the anode was continually getting coked with peroxide, but by a careful adjustment of the temperature and current intensity we at last succeeded in obtaining a fairly dense deposit of lead.

The whole of the lead is dissolved out of the galena and deposited on the cathode in a high state of purity, some samples giving as high as 99.97% of metallic lead. The silver remains at the anode, together with the whole of the sulphur, as a residual mud, from which it can be removed by treatment with a cyanide solution. The sulphur can be afterwards melted and cast into rolls; in which state it is worth from $28 to $32 per ton.

A plant to produce two and a half tons of refined lead per 24 hours would cost about $7,500; and the running expenses for that time would be about $15, where water power was used.

The production of chlorine gas by Electolysis, for use in the chlorination of gold ores, is now being carried out very successfully in Australia; and could probably be utilised in treating the Ontario and North Carolina gold ores with equally good results.

Probably no metal is more difficult to extract electrolytically than zinc. It will persist in coming down in a spongy form, and no amount of care seems to stop this, for it invariably commences the moment the deposit attains an appreciable thickness. In the case of lead this spongy deposit does not greatly interfere, as the mass can easily be melted and cast into pigs; but the spongey zinc absolutely refuses to melt.

Each particle apparently becomes coated with a film of oxide, and this effectually prevents their fusing together. This spongey zinc oxidises so easily that if immersed in water it slowly decomposes it, with evolution of hydrogen; and another curious fact about it is that it will take fire spontaneously if exposed to the atmosphere after it has been dried by pressure between filter papers or a few folds of cloth.

From time to time reports are heard to the effect that the manufacture of iron will shortly be carried out in electric furnaces, but the absurdity of such statements is apparent to anyone with any knowledge of electro-metallurgy. Iron is so cheap that an electrolytic process could never begin to compete with the old blast furnace.

The subject of electrolysis on a large scale is an entirely new one.

Electrolytic methods for separating metals have been in use for many years in laboratories, and now that the developments of electrical machinery have made it possible to produce enormous quantities of electricity at small costs, a new order of things has arisen and a new scientific field is opened to investigation.

So far we only see dimly the possibilities of this new agent and for many years the failures will be many and the successes few; but enough is already known to make it safe to say that electro-metallurgy is the metallurgy of the future.

The experimental stage, is, however, being pushed forward as rapidly as possible, notably in the treatment of copper ores, but as we have already indicated, electrolysis will probably be of equal value in the treatment of silver lead ores and in the separation of copper and nickel.

Next to copper and nickel; silver, lead and antimony will probably be the first metals to be commercially extracted by electrolysis; next to them tin and zinc, but in the treatment of the last two many difficulties are encountered which are not met with in the first mentioned cases.

We are now having built by Messrs. Crompton & Co., a dynamo to give a current of three thousand ampères at a pressure of twenty-five volts; and which will be used in working our electrolytic processes on a manufacturing scale.

We believe that by working in this manner much more certain and reliable results can be obtained than by working on a small scale; this machine will, in fact, supply a sufficiently large plantt to give commercial as well as scientific figures.

In a short while we hope to report a successful process for treating silver lead lead ores; which we think would be of great value in a mining country like the Kootenay; where water power is so abundant and so easily developed.

CAPT. ADAMS expressed regret that the author was not present. He invited discussion; and

PROF. C. GORDON RICHARDSON, (Toronto) said:—There are many questions in relation to the treatment of Nickel and Copper mattes by electrolytic methods, that I should have wished to put to the author himself had he been present. The question of treating such mattes electrolytically is one, I think, agitating all those who handle such mattes. The trouble pointed out by Mr. Gibbs in his paper of the iron entering into the electrolyte, is in my opinion, of minor importance. I think that even in the case of ordinary mattes obtained in the furnace treatment, excellent results could be obtained by precipitating first, copper, and allowing the iron and nickel to go into solution; and then per oxidizing the iron by any of usual methods and precipitating it, leaving the nickel solution to be treated by any of the ordinary methods for separation. It is a pity, I think, that Mr. Gibbs did not give us in his paper, some figures in regard to the pratical cost of separating the different metals in the mattes by electrolytics.

DR. RAYMOND:—Mr. President, my attention has been attracted to one or two points in this paper, and in the first place to the statement at the very outset, that the electric process by which aluminum is now produced could not be fairly described as electrolytic. That statement is true as applied to the Cowles process; it is true in that process, as Mr. Gibbs has stated in his paper, that the reduction of alumina is performed at a very high temperature and in the presence of carbon, and may fairly be called an ordinary reduction by smelting; but that is by no means the case in the Hall process, which is the successful process in the States by which aluminum is now manufactured in large quantities, on a working scale, by which the price of aluminum has been brought down to about 50 cents a pound. The current is not over five to eight volts. The heat is very low. There is no way of interpreting it as a reduction by heat or a reduction by carbon. There is a bath of double chloride and fluoride. In that bath pure alumina is reduced. The bath remains practically unaltered. So I should object to Mr. Gibbs' statement that there was no electrolyte process for reducing aluminum, althought it is true there is no successful process for its electrolyte reduction from an aqueous solution of any of its salts. It is true, as he says, that we have not succeeded in making an electrolytic reduction of base bullion, (silver and lead). It was tried many years ago by Mr. Keith, and our best metallurgists do not like it; they do not think it is equal to other methods of refining. What surprises me is that Mr. Gibbs should think that he could do better with silver combined with galena than with silver and lead; for if he starts from the proposition that he cannot handle base bullion, then I do not understand how he gets any encouragement about the ores. When he says he can do it with pure galena, I am reminded that he will not get pure galena in practice, but must handle galena with zinc blende and pyrites and a great many other disagreeable ingredients.

MR GARRISON.—I do not agree with Mr. Gibbs; for while it is excellent for many special purposes, more particularly the refining of metals, its application to raw ores is attended with many serious difficulties, which I doubt it is possible to overcome. Furthermore, the resources of thermo-metallurgy have been by no means exhausted. The subject of thermo-chemistry, which is the true basis of furnace metallurgy, has been very slightly studied. It therefore contains great possibilities of which we can form but little idea. A case in point, I will take the liberty of saying, was the substance of a paper read by me yesterday before the American Institute of Mining Engineers, upon lhe production of metallic manganese free from carbon, in which the metal alumina is used as a reducing agent. Heretofore, carbon in the form of coke, coal or gas has been our sole reducing agent. It is therefore possible that other reducing agents may be discovered which will in a measure replace carbon. Of course it should be understood that we will probably never have any agents with which to reduce ores from their raw state to compare in cheapness with carbon.

MR. FRANCHOT—I have nothing to say about the paper. I am very sorry Mr. Gibbs is not here to-night; but he is in Ottawa, and he will be here to-morrow; when I will make it my business to hand him over to the tender mercies of the gentlemen, and I will pick up the pieces and carry them home.

MR. MERRITT—The discussion has gone upon reducing agents. This is a matter of very great importance to us here. In our Lake of the Woods district and the Madoc district we have very refractory ores. If they could be used as has been done in Montana, and I believe, Colorado, in making use of the pyrites and the sulphur as a reducing agent, and the iron too, to some extent, it would be extremely valuable. If any of our American friends, who happen to be thoroughly conversant with sulphur and pyrites as a reducing agent, could give us a few notes on that, it would, I say, be extremely valuable with regard to our local refractory ores existing in the districts I have mentioned.

MR. GARRISON—I would say that I have been occupied in defining two reducing agents. We did not discover the fact that aluminum was a reducing agent; but merely took advantage of a well known chemical fact and used it. We did the same thing with silicon. Previously the only use to which sulphur had been put was to generate the heat in roasting the ores. I should be happy to examine some of that ore referred to for the gentleman in the future, and if we could add still another reducing agent to our list we should be more than gratified.

PROF. RICHARDSON—In speaking of reducing agents, I find myself somewhat at sea when brought in contact with silicon and aluminum as reducing agents. The question to practical metallurgists is: What is the cheapest reducing agent? I do not think that we will be able to supplant carbon, except in special cases; for in the first place we have to reduce silica or aluminum before you can use it in its turn as a reducing agent. Sulphur has been suggested as a reducing agent by the English metallurgist, Barks, in a process for which he has obtained a patent in England and other countries. This applies to the reduction of nickel silicates in the new Caledonian ores, by the addition of sulphur or compounds capable of giving up sulphur to the nickel ores; and the metal is precipitated as nickel sulphide in the form of matte.

DR. RAYMOND—The question that the gentleman on my right asked had reference I suppose to the pyritic smelting which has been carried on in Montana and Colorado; and so far as the last speaker's remark is concerned, I perhaps as the secretary of the American Institute of Mining Engineers, should come to the rescue of my friend, Mr. Garrison, and say that his use of aluminum is for the manufacture of metallic manganese, in which they want to keep the carbon out. So far as pyritic smelting is concerned, I don't believe we can consider that sulphur plays any reducing part, for it takes no oxygen from any ores. We reduce the ordinary pyrites to a lower sulphide, take out part of the sulphur, and by burning that, melt the rest, and get up heat enough to flux the earthly impurities by adding quartz. You cannot do that unless the ores will permit. The thermal calculations show a very narrow margin, so narrow that it is considered necessary to have an outside means of heating the blast. With a blast, heated outside with an independent source of heat, pyritic ores of a certain quality can be matted, and the earthy impurities fluxed off at the same time, and all without putting any fuel in the furnace. Half of the sulphur that is in the ore acts as fuel. The process, I believe, is now running in Colorado and Montana; and the company has established a head:quarters in San Francisco and is now engaged in hunting up pyritic mines that suit the process. It is not suited to replace our ordinary methods of roasting and smelting ores containing lead.

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## Notes on a Recent Visit to West Kootenay, B. C.

CAPT. R. C. ADAMS, Montreal—As the title implies, this paper consists of notes upon a visit and not notes upon West Kootenay. By the selection of this theme I am relieved from the necessity of repeating the geological descriptions which will be found in the reports of Dr. George Dawson or the account of recent developments which has been given in so interesting a manner by Mr. Charles F. Lain in the last number of the *Canadian Mining and Mechanical Review*. All who are concerned will find in print full information upon these subjects from the best authorities. All I need say is that in the District of West Kootenay many discoveries of silver bearing ores and some of gold have been made and that each year a new region is opened claiming to be richer than the last.

Interest at first centered around Toad Mountain near Nelson, where the famous Silver King mine was opened up and 1½ millions worth of ore proved to be in sight. Next the Hot Springs or Ainsworth District showed its treasures. After this the Slocan revealed large deposits of high grade ores and no sooner were these being developed that news came from the Lardo of great finds; and reports from other districts show that over a large extent of country there exists a profusion of veins of argentiferous galena so great in quantity and high in quality that the people predict Kootenay will become the great silver producing region of the world.

As one approaches the district he meets the outlying prospector, who informs him that a visit to the wilds of the Kootenay is needless, as he owns the best claims yet discovered and owing to necessity will sell them for a song, only a few thousand dollars. But pushing on to Nelson, more prospectors are met who have more of the very best claims at still lower prices, and the real estate man tells you that the way to get rich is to buy town lots, proving his case by the information that a corner lot in Nelson, bought four years ago for $100, has just been sold $4,000. In the month of March last I arrived at the town-site of Kaslo, where lots can be had for $50 to $100, the town then consisting of two houses, an unfinished store and numerous tree stumps. But in October I found there more than 50 houses; the $50 lots have become worth $500, and there are rumors of corner lots being sold for $3,000.

Kaslo is the western gate to the Slocan region, and a trail of thirty miles leads to the trail up Carpenter Creek from New Denver and along this stretch of forty miles, but chiefly in the middle twenty miles lie the many "bonanzas." Hiring a cayeuse, that you are assured will not buck, but who terrifies you with what are said to be "playful antics" when you first mount, you slowly walk the animal along the rocky trail through the dense forest, where pines and cedars in interminable procession rear their stately forms. One needs a steady head to ride along the edge of the sheer precipices sloping away for a thousand feet and confidence is not increased by seeing below the dead carcase of a horse that the day before by one false step rolled down to destruction. But some assurance is gained upon meeting a horse that the pack-driver tells you rolled over and over for 300 feet down a slope that day, with 250 pounds on his back; and the only record is a cut on the mouth that gives to his face the expression of a self-satisfied smile, as of one who is proud to have done what few cayeuses have ever lived to hear told. At night one is glad to find shelter in a log cabin; but with potatoes at ten cents a pound and hay at $60 a ton, rations are limited for both man and beast. The pony is left to browse on the leaves and shrubs, and the man is treated to bannocks, pork and beans and tea. The next morning a start is made on foot up the sides of a mountain whose head pierces the clouds at an elevation of 7000 feet. Many weary hours are spent slowly climbing to the so-called trail, across which the great fallen trees lie as barriers or sometimes serve as dizzy bridges across deep ravines, whose rocks promise death for a slip. A plant called Devil's Club grows profusely through the under-brush and if the barbed thorns enter the flesh there will be sorry time before they get out. Towards night the summit is reached and after the bannock is baked in the frying pan before the log fire and the beans are boiled, the bacon fried, the miners and visitor satisfy their hunger and exchange reports of mineral wonders for the news of the outside world. Four men sleep side by side on fir boughs in a tent six feet wide, and in the morning in a cold rain they start out to see the prospect. A snow slide has cleared the ground and down this ravine runs a vein ten to forty feet wide streaked with seams of galena, varying from two feet to a few inches in width, but so plentiful that the whole mass would concentrate one half mineral Tracing this vein over an exposure of 400 feet, the summit is climbed and descent made down the other side to where a cross cut has revealed a solid vein of galena three feet in width, and the belief is expressed that the ore runs all through the mountain from one side to the other and "there's millions in it." Descending the mountain the smooth shoes of the tenderfoot slip upon wet surface; many falls are experienced and the quick firm grasp of a miner only saves him from rolling down the gully.

In other locations strong veins are seen; and the great galena boulder of 66 tons that has rolled down the mountain from the vein above. Assays are reported giving from $50 to $10,000 to the ton and an examination of an assayer's book at New Denver shows that 260 assays, varying from a trace to 1,500 ounces, gave an average value of 250 ounces of silver per ton.

In the latter part of the fall a wagon road has been built from Kaslo, some twenty miles, and will be extended in the spring, and the railroad is soon expected to follow. Although it now costs $75 per ton to mine and ship ore to the U. S. smelters it is believed that the cost will be reduced to $20, and if the ore averages for silver and lead a value of $150 per ton as has so far been proved and the smelting charges are not over $20, there will remain a profit of over $100 per ton, and if the output is from 10 to 15 tons a day the returns will soon build up fortunes. Miners ifs are proverbially uncertain and if the veins prove small and do not go down, and silver does go down in the market and capital is discouraged from providing transportation, the one ton daily sent down the mountain on ponies' backs and costing over $100 to market, will only serve to buy another tombstone for a broken hearted "busted miner." Some scholarly young men from the School of Mines declare that the minerals will not be found at depths, and hundreds of good prospectors from Montana and Idaho found nothing on the surface and went away disappointed. But numerous diligent seekers have been rewarded and many of the men met with on the trail or in the "half-way" cabins at night pull out of their pockets fine specimens and tell of the great veins of rich ore that exist on the claims they have located.

"A careful study of the Kootenay district, during two visits the past year, convinces me that while many of the mineral grades, are narrow, pockety and of low grade, there are enough that are wide, continuous, and of high grade to ensure a large output of good value. For a mining region the possibilities for transportation are exceptionally good. The Slocan mines lie midway between the two systems of water carriage, on the Arrow and Kootenay lakes. Wire cables, (aerial tramways), can bring the ores to the valleys, and wagons, tramways or railways, can take them to the water, and later on direct by land to the smelters. Nature has done her part in bestowing upon British Columbia, great stores of mineral wealth, and providing the routes for transport. A great and speedy development may take place, which will greatly add to the prosperity of the country, and the wealth of many individuals, could man follow nature's leadings and permit industry to pursue its intelligent bent unhampered by the fetters of fiscal laws and special privilege. Nine-tenths of all the people working in the district are from the United States. Nearly all the capital is supplied from that quarter. The best mining machinery is made in Chicago, and San Francisco. The mine owners naturally wish to buy the supplies with which they are familiar and make their purchases in their own country. Numbers of smelters have been built in Montana and Washington, and these want the lead ores to use as fluxes with the dry ores from other localities, and can afford to work them at low prices on account of their desirable character. All parties wish to see railroad communication established with the South, and they see that this is essential to the growth of the district. Three great factors are left for man to provide to supplement nature's bounty and realize the vast treasure of wealth now locked up in the massive and inaccessible mountains. These are mining supplies, smelting facilities and railway transport. But what do we see? Incredible sight in a so-called age of freedom in the end of the 19th century on the continent of America, liberty's vaunted birthplace. Three officials, each wearing a badge labelled "Patriotism," stand at the Boundry Line and by their exactions paralyze the efforts of the earnest and enterprising workers. The first official seizes the mining supplies and demands one-third of their value in the name of the Crown. The second official stops the ore and says that his Uncle Sam must have $30 a ton on all the lead. The third official says all Canadian products must be moved through Canada by Canadian railways; no transport facilities to the South must be permitted. So timid capital hangs back, and the country languishes waiting for a brighter day and a wiser generation, when industry will not be taxed and men will cease to hinder the worthy efforts of their fellows.

The Canadian Government, seemg in some measure the injury of the tariff to the mining industry, has allowed free entry of mining machinery of a kind not made in Canada. But most of the ordinary articles are made in some fashion in Canada, or else some village blacksmith will pretend to make them, and the concession is of doubtful value. The smelters of the United States are demanding free lead, for they see capital going to build rival smelters in Mexico and Canada. In this case both countries are injured by the restriction, for although a quarter of a million of N. Y. capital has been expended in building a smelter in the Kootenay, the facilities of the U. S. smelters are also needed. Owing to a policy which never permits railways nor builds them, a great district in which the population has increased five fold within a year has been left during the winter without communication except by a horse trail for sixty miles in one direction, and long sleigh roads in another Serious fears of famine have been entertained, and the development of the country has been seriously retarded by the difficulty of ingress and egress.

But indefatigable men are triumphing over both natural obtacles and human opposition, and a railway from the South will be completed to Nelson the year. If further hindrance to transport ceases, and if the Governments of the United States and Canada will remove their duties upon minerals and mining supplies, a future for British Columbia will open, surpassing the fondest hopes of those who first bound her in the family bonds of Canadian unity. But it is wise to say and give warning, and that without any reference to party politics, that unless the cry of British Columbian workers, "hands of" is heeded, there will be likely to come a breaking of the nominal tie that binds that country to her eastern relatives two thousand miles away, and she will affiliate in name, as nature has destined her to do in fact, with the populous and prosperous regions that adjoin her to the south.

But let us hope that wisdom and justice joined to that love of freedom which is the strongest sentiment in the Anglo-Saxon breast, be it under the Union Jack or the Stars and Stripes, may so determine the course of both nations that human effort may be unhindered, and the wealth of British Columbia's mountains may make glad the whole continent of Columbia."

The hour being late, the following papers were read by title:—

"Notes on the Mineral Resources of New Brunswick," by W. McInnes, Ottawa.

"The Future of Mining in the Province of Quebec," by J. Obalski, Quebec.

"The Iron Ores of Frontenac and Leeds, Ont.," by J. Bawden, Kingston.

"The Bog Iron Ores and Ochres of Champlain County, Que.," by A. P. Low, Ottawa.

"The Manufacture of Charcoal Iron from the Bog and Lake Ores of the Three Rivers District, Que.," by P. H. Griffin, Buffalo, N.Y.

A Series of Papers by Members of the Mining Society of Nova Scotia on the Modification of Working Coal, lately introduced in the Province of Nova Scotia.

"The Crawford Gold Mill," by Capt. MacDuff, Waverley, N.S.

These will be reproduced in full in the next issue of the Review. The meeting then adjourned.

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## The Works of the Canada Iron Furnace Company at Radnor, visited by Delegates to the International Mining Convention.

The proceedings of the International Mining Convention terminated, on Saturday 25th February, with an excursion to the works of the Canada Iron Furnace Company, at Radnor Forges, Que.

The Company was formed in 1889 for the purpose of acquiring the iron interests of the district of St. Maurice, including iron works at Radnor Forges, together with all accessories, such as a village of sixty workmen's cottages, limestone quarry, perfected water power, clay pits, railway line, bridges, sidings, and other valuable property; also car wheel shop, and shipping dock situated on the River St. Lawrence at Three Rivers, Que.; property forming site for permanent battery of charcoal kilns, together with water power on the River St. Maurice, at Grandes Piles, Que.; ore deposits of Lac-a-la-Tortue, together with ore rights, over 100,000 acres of ore bearing lands and lakes at other points in the district of St. Maurice and vicinity.

After operating the antiquated stone stack at Radnor Forges (capacity 4½ tons per day), for some two years, in an experimental way, the Company proceeded to develop the entire property, systematizing the collection of ore and wood, by establishing ore depots, wood camps, charcoal kilns, etc., at the most desirable points throughout the territory controlled by them, and finally building at Radnor a modern blast furnace plant, complete in all necessary details, and capable of producing every day from 40 to 50 tons of high class charcoal iron.

The furnace is splendidly situated in the very centre of the ore fields, and in close touch with the wood limits, not only of the St. Maurice, but of the vast territory extending to the north and south of the river, which is, as yet, primeval forest.

The Riviere-au-Lard, on the bank of which the furnace stands, affords an excellent water power for operating ore and stone crushers, for pumping water to the furnace belt, for fire protection, and other necessary purposes. The waste gases of the furnace are utilized for fuel, and the plant itself operated therewith. The immediate plant consists of the following:—

*Furnace Stack* Height, 40 feet; bosh, 9 feet diameter crucible, 5 feet diameter; height of bosh line from hearth, 13 feet; 4 tuyeres of 3½ inch diameter.

Crucible and bosh from mantel ring down is encased and protected with Russell Wheel and Foundry Co. water jacket.

Furnace top is provided with a bell and hopper, capacity of which is 25 bushels.

*Hot Blast Stove.*—This is of the pipe pattern, with a combustion chamber below. Dimensions are: Length, 24 feet; height, 18 feet; width, 9 feet 6 inches. Sixty-eight openings between combustion chamber and pipe chamber above.

*Steam Power.*—Consists of four steam boilers, each 4 feet diameter by 25 feet long, with two 18 inch flues; shells are of 3/8 inch plate and double riveted. All boilers connected with a brick chimney 75 feet high, and all are bricked separately, and arranged to fire with either wood or gas. Gas connections are made so that boilers can be worked in batteries of two each or more, and one or two can be laid off for repairs or cleaning at any time.

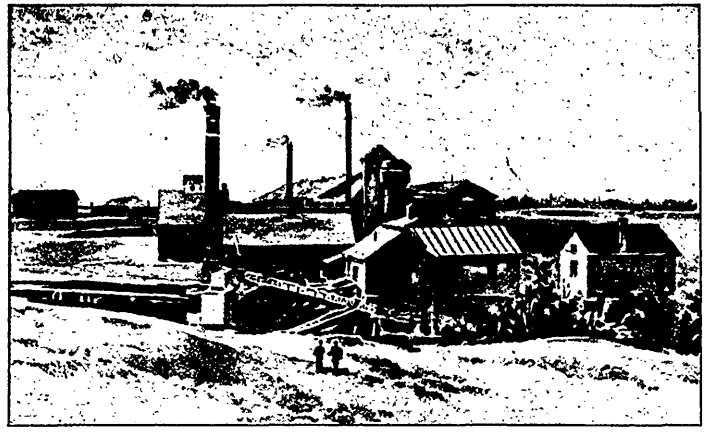
*Water Power.*—This consists of a head of 24 feet, with a "New America" wheel 35 inches in diameter, capable of delivering 65 horse power.

*Blowing Engines.*—New Weimer blowing engine, size 16 x 48 x 30, set up on a solid stone foundation, which rests on a limestone bottom. This engine is provided with a patent water heater and a Scanlan patent wind receiver and heater, capable of raising the temperature of wind to about 200 degrees Fah. before entering the hot blast stove.

*Auxiliary Blowing Engines.*—These are of the horizontal type, with two cylinders, each 40 inch diameter by 46 inch stroke, and are geared to be driven either by a horizontal steam engine of 14 x 20 inch cylinder, or by water power. These engines are complete with their own wind receiver and pipes, and are so arranged that they can be used in case of an accident to or a shut down of the Weiner engine. They deliver about 2,100 cubic feet of air per minute, with a pressure of 4½ pounds. The whole is set up in an engine house entirely separate from the Weimer, and is isolated from the latter and the boiler house.

*Steam Pumps.*—One Blake duplex pump, 12 x 7 x 12; one Holly boiler feed pump, 8 x 10 x 4; one Niagara boiler feed pump, 6 x 4 x 6; one Northey volume pump, 6 x 5 x 7.

*Force Pumps.*—One horizontal force pump, 4 x 8; one



Furnace Works of the Canada Iron Furnace Co. at Radnor Forges, Que.

CANADA IRON FURNACE CO., Ltd.

Geo. E. Drummond,
*Managing Director and Treasurer.*

Thos. J. Drummond,
*Secretary.*

John J. Drummond,
*General Superintendent.*

Battery of Charcoal Kilns at Grandes Piles, Que.

double-acting Plunger force pump, 5 x 10.

All the above steam and force pumps are so connected that they can be used either on the furnace water jackets, tuyeres, for general fire purposes, or for boiler feed.

All the suction pipes in connection with new engine house are laid through a stone tunnel, which leads from engine house to river, and are always beyond the action of frost, and so arranged that alterations and repairs can be made at any time, as the tunnel is large enough to allow a man to pass or work.

*Hoisting Power.*—This consists of a Crane pattern double cylinder hoisting engine ; size of cylinders, 8 x 10 inch. This engine is connected with two hoisting cages, having a lift of 15 feet from floor of weigh-house to floor of top-house.

*Charcoal Kilns.*—Radnor Forges Battery consists of :—

8 rectangular kilns, capacity 55 cords each ; 3 beehive pattern kilns, capacity, 55 cords each.

Grandes Piles Battery consists of :—

14 beehive pattern kilns, capacity, 55 cords each. Others in course of construction.

Charcoal also made and supplied from pits in the Sweedish manner.

The buildings and real estate in connection with the entire plant is the property of the Company in fee simple.

*Ore Supply.*—Investigation carefully carried on by practical men, under the immediate direction of the officials of the Company, and verified by actual work in the field, has proved beyond a doubt that there is not only an abundant supply of ore in sight to last for many years to come, but that it is steadily grow-ing, and new discoveries are being made daily. These ores of course vary in analysis, but the supply is so large that the Company are able to make such selection from the vacious deposits as to be able to produce fixed results. The Company have their own laboratory, and a practical chemist is permanently employed in the selection of ores, and the analysing of the furnace product.

*Limestone.*—There is a splendid limestone quarry side by side with the furnace, furnishing a valuable flux at the minimum of cost.

*Charcoal.*—The Company have two batteries of kilns, one situated at Radnor Forges, and the other, the main battery, at Grandes Piles on the River St. Maurice. The supply of hard woods suitable for charcoal making is almost inexhaustible. The main kilns located on the Company's property at Grandes Piles can draw supplies from the banks of the St. Maurice for half a century to come. The location of these kilns secure to the Company the practical control of the navigable waters of the St. Maurice, Grandes Piles being the terminus not only of the railroad but also of navigation. The Laurentian range of mountains presents a barrier to the railway going farther north, whilst the succession of magnificent water falls and rapids between Grandes Piles and Three Rivers absolutely prevents the navigation of the St. Maurice to the south. This property also gives the Company control of the Grandes Piles Falls, which with a drop of 40 feet has a volume of water representing a power not less than 35,000 h.p. It is difficult to estimate the value of this great natural water power. Naturally it is much enhanced by the fact that it occurs at the junction of railway and navigation, and sooner or later its development will offer a splendid investment.

The vast territory to the north watered by the St. Maurice and its tributaries and estimated as 200,000 square miles, contains an immense quantity of pine and spruce, and at the present time its limits are attracting the attention of American capitalists, as evidenced by the fact that the American Laurentides Pulp Co. have already expended hundreds of thousands of dollars in the erection of a pulp mill and in perfecting the water power at Grande Mère, a few miles below Grandes Piles. Aside from the manufacture of pulp, the lumber produced from the spruce of the St. Maurice is of a class coming more into use every day, as taking the place of the more expensive pine. Hard woods, such as maple and birch, are to be found in an almost inexhaustible growth all along the banks of the St. Maurice, and are specially suitable for the manufacture of charcoal for the smelting of iron. It is from this section the Company will draw its supplies for some years to come, and with great benefit not alone to itself but also to the settlers on the river, who find that in clearing their lands they are able to chop and dispose of their standing wood to the Charcoal Works at good paying figures, thus finding a cash market for what would otherwise be to them practically worthless material.

In addition to the valuable ore deposits and wood limits controlled by the Company they possess rich deposits of ochre, suitable for metallic paint, and also (on the property at Radnor Forges) valuable clay deposits suitable for making the finest quality of re-pressed brick.

The work of bringing the furnace plant and accessories to its present condition has been no easy task, and if in many respects Radnor Forges may seem to be behind American furnaces at the present moment, yet given sufficient time for a further development and proper systematizing, there is no reason to fear but that the works will eventually make a very creditable showing. American furnace men, the majority of whom are able to purchase their raw material, such as ore and charcoal, in the open market, will appreciate the difficulties of establishing a new furnace in what may be termed "The Wilderness." The Canadian furnace man has, so to speak, "to live within himself," to provide workmen for his entire cut of wood, to transport same to his charcoal kilns, and the charcoal to the furnace. He has also to "mine" his full supply of ore, and other necessary material. All this the officials of the Canada Iron Furnace Co. have had to do, and the greater part of the reorganization and systematizing has been carried out within the space of one year, and that too concurrently with the construction of the plant itself.

Among the serious difficulties the Company have had to contend with, was the fact that owing to stagnation in the lumber interests of the St. Maurice district, there was at the time of the inaguration of the Company, a great scarcity of labor, the workmen having left the country in large numbers. Further the officials had to contend with great difficulties in their attempt to change the weights and measures that had been in vogue in this territory for many years, for instance, the *habitants* at first positively refused to supply wood of greater length than three feet and the Company desiring to be in the same position as their American competitors had to set to work to change this to the present standard of four feet, in the face of considerable opposition from the *habitants*. These alterations have been carried out without undue friction, and the American standard is now used in all departments. Furnacemen will fully appreciate the difficulties referred to.

In carrying out all the operations of the Company, upwards of 800 men are directly and indirectly employed during the season, the majority of whom are engaged in the securing of ore and wood supplies. Through proper systematizing the Company's employees are now taken largely from the ranks of the farmers or *habitants*, who work for the Company during their slack season between seed time and harvest, and in the winter months. These men find the work profitable in clearing their lands by supplying wood to the charcoal kilns, and in raising ore on portions of their farms which would otherwise be unproductive. In this way the work of the Company goes on almost continually over a very large territory, and the supplies of both labor and material so obtained are therefore now practically unlimited.

## The Excursion.

(By our Junior Reporter.)

To have your "innocent sleep," the sleep that has "knitted up your ravelled sleeve of care," broken by a fusilade of vigorous knuckles upon your door ; and to rise from a comfortable bed at half-past six, a.m., when you are not in practice for the seeming hardship, appears an action, heroic in itself, which should require some strong and alluring incentive. One remembers, doubtless, the time of life when we rose at five—or earlier, if the sun set the example, for we never let him get ahead of us in those days—to go fishing with some Tom Sawyer or Joe Harper, of our youthful and adventurous bosom. But that was very long ago, we think with a sigh, as we grope sleepy-eyed for our watch, For we want to see the time, to make very sure that the porter is not making us get up an hour too soon ; and who still lingers outside, not feeling quite certain that we are up. But our chronometer has stopped in the Waterbury watches of the night ; and so we viciously pull on our clothes and shout to the doubting Thomas outside that we are up, feeling the case is quite hopeless, and that the incentive is too potent to admit of even dreaming of going to bed again—and dreaming.

For the reward of this particular morning is the long talked-of trip to Radnor Forges ! It is a glorious day, anyway, we say, as we wrestle with our refractory collar stud, and look out of the window at the God-given sunshine laying its long golden fingers caressingly upon the white tresses of the dying Winter. We are dressed at last, as the ladies say, and we hurry down and get breakfast; and, half an hour later, are aboard the excursion train gliding out of the old Dalhousie Square (Canadian Pacific Railway) station on this brisk Canadian morning.

The excursion train in question left Montreal about 8 a. m. with a jolly, rollicking lot of representives of the American and Canadian Mining Associations. There was a fair element of ladies, too, on board, serving as a sort of sprinkling of delicious perfume upon the kerchief of pleasure ; and tempering with their fine eyes and presence the men of steel. Hygeia and Boreas appeared to have been propitious to the excursion ; for every individual on the train seemed the embodiment of good health and spirits, and the old North Wind god had gone himself on a holiday of his own. It was one of those still, white Canadian days when all the earth seems wrapped in a mantle of dazzling sunshine, and which makes the visitor of sportsman-like proclivities, experiencing it, exclaim hungrily : Gad ! What a day, and what a climate ! Say, you fellows, would't you like to be out there with pair of snowshoes on, after some game, with Ed. W. Sandys for a guide ?

Continually passing through the cars to see that each one is thoroughly enjoying himself, the hosts of the occasion, Mr. T. J. Drummond, and his brother Mr. G. E. Drummond, of the Canada Iron Furnace Company make everyone feel perfectly at home ; if such an expression can be used in relation to such an unstable business-like affair as a train. About eleven o'clock a luncheon, that was a little poem in itself, punctuated by the popping of numerous corks, was served ; and between twelve and one o'clock Radnor Forges was reached.

Here everyone alighted, and went and saw and was conquered. To one conversant with the technique of an industry such as that of the Canada Iron Furnace Company, the visible working of that industry and the evolutions of the ore must of necessity be intensely and specifically interesting. But to a novice, to one who has only partially understood and appreciated the value and vastness of a great industry, the visible working in question has a peculiar charm. He realizes that he must *see* to understand and to estimate fairly.

The party first visited the casting-house where the ore come down from the furnace and is run off into pigs weighing about 150 pounds. There were about 200 or more of these pigs in this one building alone, lying in their little graves of earth which the workmen were throwing upon them, and looking to the wide-eyed treasure dreamer in their great heat like so many bars of red gold. Miss Poulin's famed hidden wealth would be as nothing to it !

Then we all went up to the furnace, crossing at a leap on our way the stream of hot slag that flowed away to the side of the building, and that made one think of the lava of a volcano. Here, at the furnace, we saw the bog ore and the charcoal and the limestone poured liberally into the gaping mouth of the funnel-like throat of the furnace, that seemed a veritable insatiate dragon, whose breath was flame.

Later on we adjourned to the new and neat little Episcopalian church, which had not at that time been opened. It is a bright little building, built for the accommodation of Episcopalians and Roman Catholics alike, the Roman Catholics attending the Church of England service held in the Sabbath evenings. It is capacious, too, this church, for no one would have thought by an exterior glance that it could hold such a number of excursionists and villagers as flocked to it on that memorable occasion of the 25th February.

So we all filed in and took our seats, and Capt. Robert C. Adams of Monteal, took the chair.

THE CHAIRMAN—After mentioning the fact that the gathering had only a very limited time to spend in the church and listen to the gentlemen who were to speak said : "We are met in this church to do honor to an industry which has existed for many years, and which has come to a joyous condition of being ; and we believe that under the able and continued management of the gentlemen of whom it has been our very good fortune to be the guests to-day, there is a very great future before this industry. We can but regard these gentlemen as philanthropists, who, by the medium of such an industry, provide a means of livelihood to many people, and help to sustain and elevate the vigor and industrial greatness of a country. I say it is right that a celebration should be held in a church in honor of an industry which is so closely united with the sentiments and practices of philanthropy. I observed in the admirable souvenir which these gentlemen have prepared for us that this delightful and romantic region is also likely to prove one of advantage to the treasure hunter ; and I now understand why we had such an easy journey down here this morning, because I am reminded of an old saying : *facilis decensus Averno.* But now that we have taken refuge in a church we shall escape any advances which his Satanic Majesty might be pleased to make.

I have received letters of regret from the following distinguished gentlemen, who were to have been with us to-day, but who for one reason or another have been prevented from doing themselves and us the honor of attending : Consul-General Knapp ; The Lieutenant-Governor of Quebec ; The Hon. Mr. Flynn ; The Hon. Mr. Louis Beaubien ; The Hon. A. R. Angers ; The Hon. Mr. Mackenzie Bowell ; The Hon. Mr. Tupper ; The Hon. Mr. Costigan ; The Hon. Mr. Patterson ; The Hon. Mr. Ives ; The Hon. Mr. Haggart ; The Hon. Mr. Ouimet ; The Hon. Mr. Smith ; The Hon. Mr. Laurier ; Sir A. P. Caron ; Sir Joseph Hickson and Mr. L. J. Sergeant of the Grand Trunk Railway.

I have now much pleasure in calling upon Dr. Howe to address you.

DR. HOWE (Boston)—Mr. Chairman, ladies and gentlemen : I firmly believe that an idle man's brain is the devil's workshop. How often has been deplored through Northern New England and Canada the lack of suitable employment for the farmer and his household during the months of winter, when the necessities of the farm do not call for the exercise of much labor. The greatest benefactor to Northern New England would be the man who would bring to the farmer an industry which would occupy the members of his household during the spare and idle time of the year. A long and important step in this direction has been taken by our hospitable young hosts of to-day in teaching the farmer how to mine bog ore, which everywhere in this district surrounds him, and in furnishing him a steady and valuable market, enabling him to use his spare time to advantage, and to utilize a waste product ; transforming a noxious article into a priceless one. For this they deserve the thanks, sympathy and support of the whole community, and for their kindness and unbounded hospitality we all thank them cordially, and wish them God speed in their good work.

DR. R. H. RAYMOND (New York)—Mr. Chairman, ladies and gentlemen : Agriculture and mining are, I would say, two great industries, neither of which can get along alone. We have found out one side of this truth in the United States, where the mining engineer and the mining pioneer have attempted almost in vain, and with unfortunate sacrifices, to put that industry into operation in countries where it was not supported by any other, and where the business of mining had to carry upon its back the load of all the necessities in the life of man.

Here we have an illustration of the opposite side of the same truth, where mining comes to the rescue of agriculture ; as our president has expressed it, by utilizing those forces and also by putting into the very neighborhood of the man who brings forth the products of agriculture, and the man who wishes to use those forces, the wealth of the mines ; and into the hands of each the power to

benefit by them. Thus bringing the producer and the market close together. The progress of science has continually necessitated that one thing should be superceded by another; and yet this is by no means true in a strict sense. If you will allow me the metaphor in this edince, you will remember how in the history of the Jews the various tribes, the Ammonites, etc., were absolutely annihilated, according to the records of the Testament, in the first chapter; and yet you find them turning up all right in the second chapter. And so we have in many cases of a so-called superseded industry, a survival and revival that is remarkable. We call charcoal iron a deceased business. We say it is played out. But all the while there is more charcoal iron made and more wanted than ever. And while charcoal iron has the properties of charcoal iron, and while the universe retains the laws of the universe, naturally charcoal iron will remain in demand.

I cannot help feeling the great fitness of this scene and this moment, as we are gathered here from different countries and surrounded by the flags we love; and as we out through the windows upon these two great productive industries, seeing around us an evidence of the union of the Church and School—a guarantee, I trust, that learning will here be prosecuted in the fear and love of God, and theology promulgated with some respect for sound reason and education—I say, viewing and feeling this, I cannot help being conscious of how auspicious is the scene upon which the bright skies of to-day bend! I feel, and with a deep sense of gratitude—sometimes so deeply that I cannot put it into words—the privilege and the joy and the glory of having been born at this time and upon this continent! I feel, as I said to the young men of McGill University yesterday, that we have been crowned with the greatest gift ever given to man—the gift of being able to stand by and see an empire grow; to tend its infancy, to join hands with its youth, and to rejoice in the strength of its freedom! And that is your privilege and mine. There never will be, there never can be, anything more glorious than these pioneer beginnings of the greatness of the new age which you and I are privileged to look upon.

MR. A. BLUE (Toronto)—This is not the first time I have have had the pleasure of visiting Radnor Forges. A few months ago it was my privilege to spend a few days here and see the work that was being carried on by the gentlemen who are our hosts to-day. I was then very greatly impressed with the good work they were doing for the community and for the province. I was desirous of knowing what they were doing here, so that we in Ontario might be assisted by trying to do likewise, where we know the value of the iron industry by the want of it. We have been going to school somewhat to our neighbors. We have been attending the meetings of this great institute which has met this year in Montreal, and have been getting inspiration and encouragement from them. I hope the time is not far distant when we will be able to follow in their footsteps, however much behind them we may be. They began the mining and manufacture of iron very early in the settlement of their country. They encouraged the industry then, and continue to encourage it; and it is to-day I think I may say the greatest next to agriculture, which that country possesses. Here in the Province of Quebec, as well as in the Province of Ontario, we find our young men leaving us for want of employment at home. We find them fleeing from their own land. I feel very keenly the situation, and I think a great effort ought to be made to find new fields of employment for our own people, by establishing in various parts of our country industries, such as that here, so that employment may be given; and I trust that the Dominion Government, and the government of each province, will do their utmost to cultivate such industries.

MR. JAS. CRATHERN (of Messrs. Crathern and Caverhill), Montreal, said:—Mr. Chairman, ladies and gentlemen: I observe on reference to the souvenir prepared by Mr. Drummond, that the late Hon. Senator Ferrier worked the property of the Forges over 40 years ago. At that time I was a clerk in his employ, and my duty was partly to superintend the sale of the goods manufactured, which were principally at that time double stoves, coolers—which were often used for sugar purposes—bar iron, &c. The stoves were used entirely throughout the Province of Quebec, and I may say were very efficient articles. That was so long ago, however, that it would be out of place for me to ask any of the ladies present if they remember any of those stoves. If I remember correctly, the first discovery of the value of the ore was made by a company in Troy, actively engaged in the manufacture of railway car wheels. They discovered that the ore made the very best railway wheels, and I believe the gentlemen who are now working this industry are largely engaged in producing the same wheels. I am sure they are to be congratulated very much upon the progress they are making and apparently have made already; and I trust that with the continued aid of the National Policy they may be eminently successful.

The speeches and subsequent applause having terminated, we sought the train again; and after a pleasant run of fifteen miles reached Grandes Piles, situated upon the great and beautiful St. Maurice River.

Here a pleasurable surprise was in store. For no sooner had we alighted than we saw down the road, running parallel with the railway track, a dozen or more improvized open-air busses, to each of which was harnessed a pair of fine, strong, mettlesome horses, gaily caparisoned; and behind each team an expert French-Canadian driver.

Each sleigh was able to accommodate a score, having a framework of light lumber upon a pair of "bobs," with a seat and back on either side, as in pleasure vans.

In we piled, and away we sped down the road and past the bee-hive kilns, that look like so many Esquimalt castles. We go a little sedately at first; but after crossing the river and mounting some tough little hills on the further side, we enter the pine woods where the pure fragrance of the trees and the snow, and the exhilirating influence of the air and the moment make us open our mouths and draw the fresh atmosphere—the tonic of the hills—into our lungs.

Suddenly there is a shout! We know that something has happened; for our jehu with a strong arm pulls up his seventeen hands high horses to a standstill, in a moment, from a furious pace; and we behind him reel and totter and cling to each other as we are thrown off our balance. Looking ahead, we see that one of the loads has suffered a humiliating downfall in its proud career. The three thousand pounds and more of freight has been too much for the framework of the sleigh, for the latter has gone to pieces, and the occupants have been tumbled uncermoniously into the snow on either side, amid the laughter of their friends in the rear. However, no one is hurt. A portion of the unfortunates climb back upon their dismantled craft; and the ladies of the disaster are picked up by and distributed among the procession of sleighs following up in the rear.

So we speed on. We are well into the woods now. Up and down hill and round curves we go with reckless, careless abandon and spirit that is charming. Past the druids of this forest primeval, where not so very many years ago leaped the roe and rang the voice of the huntsman; where crept the wily brave, and whirred from the brown carpet and from beneath the broad branches of almost every pine and fir the prolific partridge.

Ah, what a life these Canadian *habitants* live, we say to ourselves as we feel the glow of animation and health in our veins, and look upward at the "velvet void" where the tops of the swaying pines seem to write "liberty!" What a life they live! And they now it, too, these Canucks! Your Canuck knows when he comes up to the city and sees its pettiness, and insipid pleasures, and lassitude, and need of stimulant, that he has the best of it out here in his woods, with his simple living and his glorious life and health and liberty and strength! Well might he quote:—

"Give me the life beneath an endless sky,
Whose blue afar the darker of the lake
Meets in horizon kisses! Here may I
The echoes of primeval hollows wake;
And in a joyous and exultant cry
My effervescent spirits partly slake,
Nor fear man's pigmy interdict. Here I may be
Like that which is round me—boundless, bold and free!

'Tis some small comfort in this fettered time,
When man within Convention's prison broods,
To feel I am not harnessed to the rhyme
And jingle of her brainless platitudes;
But that in freedom I may boldly climb
With Nature to her most majestic moods:
Scale mountains, stand alone, or eager feel
My pulses answer some swift moving keel!"

The bars of sunshine, that make the forest's carpet a beautiful pattern of white and gold, have grown longer. The air, as it will towards evening, even in a winter forest, has grown stiller. An ineffable peace broods over these hills. But we have been dreaming; for as we start from our reverie,—which, like a certain famous dream, has only lasted a moment—we hear the merry shouts of our companions, the quiet admonition of the driver to Pete or Rosalie; and we see that we are speeding back to the train—and home. And in a little while we are again crossing the St. Maurice River. The solemn woods are left behind us; and with a sigh of regret, we know that the drive is a thing, only to be re-lived again when, perhaps, we sit by a glowing grate on a December evening, retrospective, while Winter raps unheeded at the window pane, and dash over in memory the hills, and between the hemlock and the pines of the wildly magnificent country of Grandes Piles.

But we talk it all over as we discuss our supper with vigorous appetites and smoke our cigars on the run to Montreal. And as we propose the health and prosperity of our hosts and their industry, and of the United Convention of Mining Engineers, we agree with one voice that "the day has well been worth the living."

## AN ONTARIO SESSION.

### The Necessity of Secure Housing of the Geological Survey's Collection Endorsed—Other Resolutions of Importance Discussed.

On the afternoon of Friday a meeting of the Ontario delegates to the Convention was held in the New Club Room, Windsor Hotel, at three o'clock. A number of outside delegates also joined in the proceedings, and one of their number, Captain Matthew Penhale, manager of the Glasgow and Montreal Asbestos Company, was called to the chair.

PROF. C. GORDON RICHARDSON, (Toronto)—The first resolution upon the official programme, No. 47, namely: "The necessity of enlarged and more secure housing of the magnificent collection of the Geological and Natural History Survey of Canada, at Ottawa," moved by Mr. B. T. A. Bell, was adopted at the meeting of the Quebec Mining Association this morning.

I think that we should all agree unanimously upon the necessity and value of that resolution. At the present time the collection at Ottawa, while very amply and well displayed, is nevertheless in an extremely insecure condition. That collection represents the combined efforts of the Survey since its inception. Many of the fossil collections, in fact the greater part of the collection, could not be replaced. It would be impossible to replace it. I understand that in the vaults or cellars of the house in which it is stored, are immense stacks of papers, volumes of works of the Survey, and other inflammable material, among which it would only require the careless dropping of a match or tobacco ashes to fire the whole building. And if that happened, "what hope to save the "—collection?

I therefore move, in the absence of Mr. Bell, that we pass this motion.

The motion was carried.

PROF. C. GORDON RICHARDSON moved—"That it would be in the interests of mineral and metallurgical development were a compilation made of all information relating thereto from the time of Sir William Logan's summary of reports in 1863 up to the census of 1890. Also that it would be desirable were the reports of the Geological Survey divided into two volumes, one of which should treat on the Geological work of the Survey and the other on all matters relating to Mineral Occurrences, Mining and Metallurgy. Also that the prices of Geological Survey publications should be reduced to somewhat the same scale as that charged by the Geological Survey of the United States."

He said: I do not think that in moving this resolution I need go into the reasons at any great length for supporting it. Some time ago, I think in 1887, the Canadian Institute, especially the Geological section of it, adopted a resolution of this character and forwarded it under the seal of the Institute to the Canadian Government. At that time the preparations for taking the national census were in progress. It was suggested that it would be well if a complete statistical volume relating to the mining industries and all information appertaining thereto, from the time of Sir William Logan's report of 1863, could be collected and published as a volume of the census of 1890.

For some reason or other, and on account of some antagonism, I believe, between the Statistical Branch and the Survey Branch, nothing material was done. That volume of 1863 is out of print.

It dealt generally with scientific geology, and in another part with economic geology and all occurrences of minerals known up to that time. Since then, although very much information has been collected by the Survey throughout the whole of Canada, that mass of information is scattered through the general volumes of the Survey publication, and is not in a handy form for reference. I have been asked: "What have you done in Canada in reference to mining? Has anything ever been done?" It is perfectly useless for me to refer my questioners to the reports of the Geological Survey, although there is an immense mass of information in regard to our mining industries contained therein.

When the resolution of the Canadian Institute was brought before the House of Commons by Mr. Cockburn, an answer was made to it by the Director of the Geological Survey, Dr. Selwyn, and he took exception to the statement that there was "A gap." He said there was no gap; and he then sent to the then Minister of Interior details of the work done by the officers of the Survey during that time, and also a list of the different papers upon the mining industry, which had appeared up to 1889 since 1863, starting with 1865. Now, sir, there is an immense mass of information scattered through the different publications. What this resolution asked for is that a publication of all that information which has been collected, not only under these heads, but which is also scattered through incidentally what we may term the more scientific papers relating solely to geology, be made and issued as a volume, similar to the volume issued in 1863 up to 1890; from which time annual reports of statistics issued by the division of minerals and mines have been issued. Also, that the volumes of the Survey shall be issued in two separate parts, one dealing with field geology, and the other with the mining and metallurgical industries pure and simple, somewhat similar to Days' report.

MR. GEO. A. SPOTSWOOD (Kingston)—I suggest that they shall be bound in cloth.

PROF. RICHARDSON—That would be very well; but at the present time, if you had, as I have, to write to the department about any information in regard to their volumes, and then be referred to a bookseller, you would think we will be very fortunate if we get what we desire. You are referred to a bookseller; and you are thus taxed not alone the cost of the work, but the bookseller's fees too. You have to pay something like $2.00 or $2.50, while from the U. S. government you would get their report for 50 cents.

MR. A. LEOFRED (Quebec)—How is it we get reports from the Geological Survey about three years after the work has been performed?

(Several members—Hear, hear.)

MR. R. MCCONNELL (Sudbury) seconded Prof. Richardson's motion, which was carried.

MR. W. HAMILTON MERRITT (Toronto) moved that it would be in the best interests of the country were the present bonus on iron continued by the Dominion Government, and were the question of provincial bonuses considered favorably by the different Provincial Governments. Also were the question of the manufacturer of

steel rails and of nickel-steel in Canada favorably considered by the Dominion and Provincial Governments.

He said: In my opinion, if the iron and steel industries do not affect the whole of Canada, we have but to say, God help Canada! If Canada cannot and will not deal in a generous spirit with the iron and steel industries, I have little hope for the building up of our country in in modern history. I have a letter here which I will read you, with your kind indulgence, from the seconder of this motion, Mr. E. W. Rathbun, Deseronto, in which he expresses his regret that owing to unforseen events he is unable to be present and give expression to his strong and emphatic views on this matter, which I will attempt, if feebly, to reproduce. (Mr. Rathbun's letter read.)

We in Canada occupy, permit me to say, a very humiliating position in regard to iron and steel. We are beholden, as it were, to the rest of the world, chiefly to the United States and England. This is a matter of serious moment to a country desirous of building herself up and occupying a proud position among the nations. Last year we imported more than twice as much pig iron as was made in the country. We imported $1,700,000 worth or steel rails, which may be considered raw material. Dr. Raymond pointed out this morning that the great civilizing feature of the present day is the Bessemer Converter. There is not one Bessemer Converter in Canada, and we make a very small proportion of the iron consumed in the country, to say nothing of the steel. I should have liked to have pointed out to the Americans their position, as they stood among us here in Canada.

I believe that every citizen of Canada will admit that he would require equally as much iron and steel if he stepped over into the United States, as he does in Canada. And yet he will only have one-fiftieth of what he uses manufactured for him in his own country. Iron and steel manufactures came into this country last year worth about nine and a half, or $10,000,000. Of that the major part came from the United States; $4,800,000 worth from United States, and $4,600,000 from England, showing the enormous amount which we have and which could be filled by home manufacture.

The steel rail question is rather a vexed one. The railroads desire the cheapest steel they can get. The United States dealt with their companies in a statesmanlike manner, in giving grants to their great Pacific railroads. They stipulated that those roads should be built with American steel rails; and that is the policy which should be adopted by the Dominion Government; if not even a still more generous policy. I maintain that the policy which has been adopted has not been a right one, nor in a generous spirit. When people go to war, they do not say: We are going to grant a certain sum of money and if that does not defeat our enemy we will be vanquished. They go into a fight determined to win. Now sir, I contend that should be the policy of this country and of the Government of this country, in regard to the manufacture of iron and steel. Our Government should say: We are going to make our own iron and steel, we are going to make our own rails, and, of course, in our wisdom we will adopt the best and most economic manner in which this policy is going to be carried out. But unfortunately, it appears that a certain Duty was adopted; and it was considered that if that was not a sufficient stimulant, why the industry would have to go to the wall.

Gentlemen, the Government should approach this great national and important question in a broad and generous spirit. They should decide that it is a very momentous matter indeed, a thing of prime importance, that we should manufacture our own iron and steel, and nickel steel also. And if Canada was the first to make a substantial movement in regard to the manufacture of nickel steel, it would help her considerably; because nickel steel will play a great part in the future.

It may be said that we have not the material. But that is a fallacy too absurd to dwell upon; because you are all conversant with the vast quantities of splendid iron ore and coke in Nova Scotia; and with the fact of the great iron fields of New York and New Jersey stretching away into Eastern Ontario, proving beyond a question the great supplies of that ore existing in that part of Canada alone. In Western Ontario the great Minnesota ranges run up into the Port Arthur regions, and through the western part of Canada and in Manitoba. I believe there is no question of valuable supplies of iron; and in British Columbia there is an abundance of iron ore and coking coal in the interior, and which will be of course developed when the country grows.

Therefore, I think that so far as the Dominion Government is concerned, we can very properly appeal to them to deal with this question in a generous manner.

We can point out to them that extreme protection has been necessary by all civilized countries in starting this industry. It was the case with England and Belgium, who now produce more than half a million tons each a year; and with Sweden, who produces nearly half a million tons annually. In view of these facts we can, I say, appeal strongly to the Dominion Government; and it would not be out of place for this Convention to impress upon the Provincial Governments the great importance of this industry.

I may say that I have no personal interest, either direct or indirect, in thus advocating the home manufacture of iron and steel so warmly. I have no interest in any manufactory or smelting works of any kind, nor in any mine. I merely move this resolution, from a purely scientific and metallurgical knowledge of the facts; and feeling as a citizen, and as a Canadian, that we have a great void that can be and should be filled.

Mr. Rathbun who seconds the resolution, on the other hand, gives great force to his adoption of the cause; because he is a man who is ready to put his money into the erection of a furnace. I take it the two forces should be very strong; the desire of the man who has money and is ready to invest that money in a home industry and give labor to men at home; and the desire of the man who is interested in serving the interests and the national greatness of his country.

CAPT. PENHALE—In the United States there is more iron mined and manufactured than in all the rest of the world. In 1890 over 10,000,000 tons of iron were manufactured in the United States. In the United States and in England, in the sense of wealth, Iron is King—And whether we are connected with it directly or indirectly, we all feel the benefit of that industry. Mr. Merritt stated there was not one Bessemer steel plant in Canada. If, as Mr. Merritt, said, investors are ready to put their money into that industry, then I say, make your resolutions and pass them, and get these men to put their money into the building of furnaces. And I tell you, you want furnaces.

Mr. Merritt's motion was carried.

MR. JAS. B. HAMMOND, (Sudbury)—moved "With a view to bringing nickel into more general use, its claims as an economic metal being now fully established, that the attention of the Dominion Government, and the Provincial Legislature be called to the advisability of granting a liberal bonus to the inventor or patentee of a process of refining nickel, which would very materially lessen the cost of production." He said: I have only, for instance, to call attention to the policy of our Dominion Government, with regard to putting on its feet the best sugar industry. I am aware that there are false impressions being circulated with regard to the extent of our nickel country; and in the interest of the whole country, I think we should call particular attention to the fact that not one third of the deposits of a first class character are being worked; and there is an impression going about that certain individuals, having bought up, say 30 to 40 acres a piece, have got a corner on nickel; which we from that part of the country, know to be contrary to the facts.

With regard to nickel as a metal, we have heard what has been said by Mr. Merritt regarding iron, and the disadvantages under which the iron industry has labored. When two industries are weak, why can they not be married so to speak, and hely each other through life. The parents are the Government, and the country. Here are two young industries, and they wish to be united in the bonds of industrial matrimony. In that respect I cordially support Mr. Merritt's motion.

Now, with regard to this motion, in connection with nickel as a separate metal. There is no one who will not agree but there is a vast future for nickel *per se*. The great drawback to the development of that metal industry in Canada has been the cost of refining it. We have it quoted in the market at nearly 50 cents a pound. The great advantages and properties of nickel used in employments of all kinds in connection with wares, cooking utensils, &c., &c., is that it is something which is not attacked by acids. I can see, in view of that, that we would simplify the circulation of the metal ten thousand times over if we could reduce the cost of refining it.

This, then, is a question for the Government to decide, whether they are not losing a great opportunity of engaging the attention of capitalists, or even lending the money and taking the mortgage, as I understand it, to help this young industry on its feet.

This motion particularly calls attention to the fact that we should first reduce the cost of refining, and then comes the consumption. The present processes of refining nickel are chiefly by chemical methods, and are expensive. Whether electricity will solve the question time will tell.

MR. G. MICKLE, (Sudbury)—In seconding Mr. Hammond's motion, I may say that we stand in this position; we have the greatest deposits of nickel in the world; but the consumption is so small that a few companies can supply the demand, and these deposits must be worked. With a view to increasing the consumption, I would support this resolution No one now seems to dispute the value of nickel, not only as an alloy, but as a distinct metal.

I might say, I saw an advertisement by a German nickel firm, stating that nickel was the material of the wares and cooking utensils of the future; that it was not affected by acids; that it never lost its full value as a metal; and offering to buy back all utensils bearing their trade mark.

The only obstacle seems to be the cost of refining, and with a view to the reduction of that cost, I second Mr. Hammond's motion.

PROF. C. GORDON RICHARDSON—There is not the slightest doubt that the market for the nickel itself is practically unlimited. The trouble at present which exists in regard to the nickel industry in Canada is that there is a very high wall erected between the producers of ore and matte, and the market for the fine metal. At the present time I believe I would be within bounds in saying that the refiners of nickel and copper matte might be numbered on the fingers of one hand. They practically control the price of matte placed upon the market, and the price of refined metal put upon the market. I am not of the opinion, from what little I know of the industry, that there is any special cost in the refining of these mattes. At the present time the average price I think for the nickel in the matte would not be above 13 cents a pound, and the refiners have the difference between 13 cents in the matte and, we will say, 40 or 45 cents in the refined metal. I think that this is an immense margin for refiners, and our industry is seriously hampered. I have a letter from Dr. Peters, stating that any company which entered upon the production of nickel matte without being prepared to refine that matte had his hearty sympathies; and therefore I am very pleased to give my support to the motion of Mr. Hammond.

CAPT. PENHALE—Would it not be a good thing for the Dominion Government to pay a man efficient in the business to go over to England and drum up the matter among the capitalists, and tell them what you have in Canada, and what a field there is for their money? In London the money is locked up; they are waiting to invest it. It seems to me that if the Government would spend $5,000 in that way it would do more good than all the immigration schemes they ever concocted.

MR. Hammond's motion was carried.

MR. G. A. SPOTSWOOD, Kingston, moved "That it would be in the best interests of the country if it should be made compulsory by the Government that railways to be built receiving a Government bonus should be railed and bridged with Canadian iron and steel."

MR. HAMMOND seconded the motion which was carried.

MR. G. McKAY (Sault Ste. Marie), in the absence of Mr. Thomas Ledyard, Toronto, moved "That it would be in the best interest of metallurgical developments were all fuel used in the smelting and refining of ores and metallurgical products allowed to enter duty free into Canada."

MR. SPOTSWOOD seconded the motion, which after some further discussion was carried.

The meeting adjourned at 5.30 p.m.

## McGill Mining Society.

A few years ago the number of students in the mining department of McGill College, Montreal, was so small that it was thought advisable by many to discontinue the teaching of this branch of science. Sir Wm. Dawson and Dr. Harrington opposed this, pointing out that graduates in mining had been far more successful than those of any other department, and it was therefore decided to continue the course. Mr. W. A. Carlyle, Ma. E., a graduate of McGill, was brought back from Colorado as lecturer in mining and metallurgy, and from that time the course started out on a fresh career.

This year there were 25 students in mining, and it was thought that much benefit could be derived from meeting for the purpose of discussing subjects relating to mining.

With this object in view the "McGill Mining Society" was formed last December. The officers were: B. J. Harrington, B.A., Ph. D., *Hon. President*; W. A. Carlyle, Ma. E., *President*; H. Herdt, Sc. '93, *Vice-Fresident*; A. A. Cole, B.A., Sc. '94, *Sec'y-Treasurer. Committee*: J. H. Featherstone, Sc. '93; R. A. Gunn, Sc. '94; O. C. Hart, Sc. '95; H. H. Barclay, Sc. '96.

Five meetings were held during the session, and they were very well attended by the students, the subjects being as follows:

1st. The Duties of a Mining Engineer, by Mr. W. A. Carlyle; 2nd. Life Underground, by Dr. Harrington; 3rd. A Debate:—"Resolved that Bi-metallism should be adopted by the nations." Affirmative, J. H. Featherstone, A. A. Cole, B.A. Negative, H. Herdt, R. A. Gunn.

This meeting proved very entertaining and instructive. At the close of the debate a vote of the meeting was taken on the merits of the speeches, which resulted in a victory for the affirmative. At the 4th meeting Capt. R. C. Adams gave a paper on 'Mica and Phosphate' and at the 5th a paper was given by Mr. T. Brown on 'Rock Drills and Air Compressors.'

This being the last meeting of the session refreshments were supplied and farewell speeches were given by the members of the graduating class.

On March 4th, the Society held an excursion to St. Henri to examine the works of the Ingersoll Rock Drill Company. Mr. Gilman, the manager, had a compressor and drill running for the benefit of those who had not seen these working before; and he kindly gave up his afternoon to explaining to the students the mechanism of the drills and compressors in construction.

The students have been asked to take note of any points of interest connected with mining that may come under their notice during their summer work, so as to give the Society the benefit of their observation next winter.

A bright future for the Society may be anticipated if we may judge by the enthusiasm shown this year; and the more sanguine prophesy that before very long the most flourishing society in the University will be the "McGill Mining Society."

## The Duty on Mining Machinery.

A deputation from the General Mining Association of the Province of Quebec had an interview with the Hon. Clarke Wallace, Comptroller of Customs, on Wednesday, 9th March, on the subject of a more liberal interpretation of the law respecting the admission of free mining machinery. The Comptroller evinced great interest in the various points brought forward by the delegates, and promised that they should have his careful consideration. Difficulty being experienced by the collectors in discriminating between what class and kinds of machinery were made and those which had to be imported, it was agreed o submit a statement for reference to the Department.

THE NEXT QUARTERLY GENERAL MEETING OF THE

# General Mining Association of the Province of Quebec

WILL BE HELD ON

## FRIDAY, 7TH APRIL, 1893,

IN THE

## NEW CLUB ROOM, WINDSOR HOTEL, MONTREAL,

COMMENCING AT TEN A.M.

### MORNING SESSION.

Report of Committee on Amendments to Constitution and By-Laws.

The Duty on Mining Machinery.

Report of Deputations, etc.

### AFTERNOON SESSION.

COMMENCING AT TWO P.M.

Mica: Its Occurrence, Composition, Development and Uses.

A series of papers by C. CIRCELL, M.E., East Templeton, Que.; S. P. FRANCHOT, Villeneuve Mica Mine, Buckingham; DON C. WATTERS, Lake Girard Mica Mining System, Ottawa; PROF. B. J. HARRINGTON, Montreal; and B. T. A. BELL, Secretary.

Peat: Its Occurrence in Quebec, and Utility as a Fuel for Industrial and Domestic Consumption.

By DR. R. W. ELLS, Ottawa; MR. GIBSON, Bureau of Mines, Toronto; J. McDOUGALL, St. Hyacinthe, Que.

The Kelly Sectional Boiler.—By HECTOR MCRAE, Ottawa.

### THE ANNUAL DINNER,

POSTPONED ON ACCOUNT OF THE INTERNATIONAL MINING CONVENTION,

WILL BE HELD IN THE

## WINDSOR HOTEL, AT 7.30 P.M.

SAME EVENING.

Tickets may be had on application, from Mr. A. W. STEVENSON, Treasurer, 17 St. John St., Montreal; Capt. ADAMS, 41 St. Francois Xavier St., Montreal; Mr. R. T. Hopper, 17 St. John St., Montreal; Mr. L. A. Klein, Black Lake; Mr. F. P. Buck, Sherbrooke, or from

B. T. A. BELL,

*Secretary.*

**Ottawa, 30th March, 1893.**