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JOURNAL  
OF  
THE MINING SOCIETY  
OF  
NOVA SCOTIA.

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VOL. I.

PARTS I., II., III. & IV.

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*BEING THE TRANSACTIONS OF THE SOCIETY DURING THE  
YEAR 1892-3.*

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EDITED BY THE PRESIDENT.



COPIES OF THIS VOLUME AND ALL THE SOCIETY'S TRANSACTIONS MAY BE  
OBTAINED ON APPLICATION TO THE SECRETARY

AT

THE ROOMS OF THE SOCIETY,

129 HOLLIS STREET, HALIFAX.



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## PART I.

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TRANSACTIONS  
OF  
The Mining Society of Nova Scotia.

The Society as a body is not responsible for the opinions and views expressed in the several papers presented with the Transactions.

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PART I. VOL. I. SESSION 1892-93.

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Contemplated legislative action having excited the mining community with a feeling of distrust the follow circular was issued :

HALIFAX, N.S., 15th March, 1892.

DEAR SIR,—A meeting will be held in room 20, Halifax Hotel, Halifax, on Wednesday the 30th March, at 10 a.m. of all persons interested in the formation of a United Miners' Association.

It is intended to have this Association represent all of the various mineral interests of this province and thereby promote generally the welfare of the mining industries.

You are earnestly requested to be present, or should circumstances prevent your attendance, to sign and send the enclosed slip to the Provisional Secretary if you are in accord with the objects and motives of this call.

You are also invited to ask the attendance and co-operation of any person or persons whom you think may be interested in the matter.

Yours truly,

J. E. HARDMAN,  
H. S. POOLE,  
CHAS. ARCHIBALD,  
G. E. FRANCKLYN,  
B. C. WILSON,  
GEO. W. STUART,  
J. R. LITHGOW,  
R. G. LECKIE,  
CHAS. FERGIE,  
B. G. GRAY.

} Provisional  
Committee.

H. M. WYLDE,  
Provisional Secretary,  
P. O. Box 520, Halifax.

In response to the notice of the 15th March calling a meeting of persons interested in the various mineral industries of the Province, to be held at the Halifax Hotel, on Wednesday, 30th March, 1892, at 10 o'clock a.m., the following gentlemen were present on that date :



John E. Hardman (Provisional Chairman), Messrs. H. S. Poole, Chas. Archibald, D. J. Kennelly, J. S. McLennan, A. A. Hayward, J. H. Austen, R. H. Brown, Wm. Lithgow, J. R. Lithgow, B. G. Gray, Chas. Fergie, G. W. Stuart, H. T. Harding, B. C. Wilson, T. R. Gue, Geo. MacDuff, Harvey Graham, R. G. E. Leckie and H. M. Wylde.

The Chairman briefly stated that the object of the meeting was to form a Miners' Association or Society, embracing all the various mineral industries of the Province.

Proposed rules for the governance of the Society were then read and after being referred to a sub-committee for revision were adopted as follows :—

## CONSTITUTION.

### I.—NAME.

The organization shall be called "THE MINING SOCIETY OF NOVA SCOTIA."

### II.—OBJECT.

The object of the Society shall be to mutually benefit and protect its members, by facilitating the interchange of knowledge and ideas and by taking concerted action upon all matters affecting or relating to the Mining Industries of the Province of Nova Scotia, and generally to promote the said Industries by all lawful and honorable means.

### III.—MEMBERSHIP.

The Society shall consist of Members, Associate and Honorary Members.

Members shall be persons engaged in the direction and operation of mines and quarries in the Province of Nova Scotia, more particularly mine and mill owners, parties interested in the ownership of mines, mine managers, superintendents and metallurgists.

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Associate Members shall be persons not eligible in the foregoing clause, but such persons whom the Society shall deem worthy of admission for membership.

Honorary Members shall be persons eminent in their profession or in the mineral history of the province.

#### IV.—OFFICERS.

The Officers of the Society shall consist, 1st—of a President; 2nd—Three Vice-Presidents; 3rd—a Secretary; 4th—a Treasurer; 5th—nine members in good standing, who shall act with the other officers as a General Council, five of whom shall constitute a quorum for the transaction of business.

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### BY-LAWS.

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#### 1.—ELECTION OF MEMBERS.

Application for admission to membership shall be signed by not less than three members in good standing, and sent to the Secretary. At least three weeks previous to the date of ballot the Secretary shall provide each member with a ballot slip stating the names of the candidates and their endorsers. A member voting shall sign the ballot slip and return it to the Secretary, erasing either "aye" or "no" opposite the name of each candidate. At least fifteen votes in favor of any candidate must be cast to elect, and five negative votes to exclude. Members in good standing only shall be allowed to ballot.

#### 2.—FEES.

The Membership Fee shall be ten dollars, payable annually in advance at the Annual Meeting of the Society.

#### 3.—ELECTION OF OFFICERS.

Nominations for officers shall be sent to the Secretary at least one month previous to the date of the Annual Meeting, and election shall be by ballot, as in the case for membership, on a form prescribed by the Council.

Vacancies occurring in the Officers or Council of the Society shall be filled by the Council until the next annual meeting.

#### 4.—DUTIES OF OFFICERS.

The President shall be Chairman at all meetings at which he shall be present, and in his absence one of the Vice-Presidents. In the absence of a Vice-President the members shall elect a Chairman for that meeting.

The Treasurer shall hold in trust the invested funds of the Society, which shall be deposited in the name of the Society at a bank approved by the Council and he shall present, from time to time, a statement of the Society's accounts. All checks shall be signed by the Treasurer and countersigned by the Secretary.

The Secretary shall attend all meetings, shall take minutes of the proceedings, shall be responsible for the safe custody of all papers, books and other property of the Society, and, under the direction of the Council, shall conduct the general business of the Society. The salary of the Secretary shall be determined by the Council.

The Council shall have the general control and direction of the affairs of the Society.

#### 5.—MEETINGS.

The Annual General Meeting for the election of Officers, the transaction of the business of the Society and the reading and discussion of papers shall be held in the City of Halifax, N.S. on the second Wednesday in March of each year.

General Meetings for the reading and discussion of papers and for the transaction of business shall be held quarterly at such time and place as the Council may determine.

Special Meetings may be called by the President at any time, or by the Secretary on the requisition of five members, notice of which shall be mailed by the Secretary to members of the Society. Any special business or subject for discussion shall be specified in the notice convening such meetings, and the Secretary shall post not less than fourteen days' notice thereof to the members of the Society.

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No resolution shall be recorded in the minutes for which less than ten votes are cast. No measure shall pass or action be taken in the name of "THE MINING SOCIETY OF NOVA SCOTIA" at any special meeting without the previous sanction of the Council.

6.—CONSULTING OFFICERS.

The Council shall have power to appoint such consulting Officers as may be thought desirable from time to time, and may vote them suitable remuneration.

7.—AMENDMENTS.

Amendments to the By-laws can be made at any annual or quarterly meeting of the Society, provided a month's notice of the amendment shall have been previously mailed by the Secretary to the Members of the Society.





The following Officers and Members of the Council were elected as follows.

### Officers, 1892-3.

—————

#### President :

H. S. POOLE, F.G.S., A.R.S.M., Stellarton, N.S.

#### Vice-Presidents :

J. E. HARDMAN, S.B., Oldham, N.S.

R. G. LECKIE, Londonderry, N.S.

DAVID MCKEEN, M.P., Sydney, C.B.

#### Treasurer :

J. R. LITHGOW, Halifax, N.S.

#### Honorary Secretary :

B. T. A. BELL, Ottawa, Ont.

#### Secretary :

H. M. WYLDE, P.O. Box 520, Halifax, N.S.

—————

#### Council :

PRESIDENT, VICE-PRESIDENTS, TREAS. AND SEC. [ex-officio.]

CHAS. ARCHIBALD, Cow Bay, C.B.

R. H. BROWN, Sydney Mines, C.B.

J. R. COWANS, Springhill, N.S.

CHAS. FERGIE, M.E., Westville, N.S.

C. H. DIMOCK, Windsor, N.S.

HARVEY GRAHAM, Westville, N.S.

G. W. STUART, Truro, N.S.

B. C. WILSON, Waverley, N.S.

E. A. SJOSTEDT, Bridgeville, N.S.

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AUSTEN, J

BAIRD, JA

BELL, B.

BOYD, LU

BROWN, R

CHAMBERS

CLARKE, F

COWANS, J

DAVISON,

DIMOCK, C

FERGIE, C

FRANCKLYN

GRAHAM, F

GRAY, B. C

GUE, T. R

HARDING, I

HARDMAN,

HAYWARD,

HOLMES, H

HOWE, C. I

JENNER, E

KENNELLY,

LECKIE, R.

LECKIE, R.

LITHGOW, J

LITHGOW, V

MATHESON,

MONCKTON,

The following is a list of the original members.

MEMBERS.

ANDERSON, JOHN H.,	Musquodoboit Harbor, N.S.
ARCHIBALD, A. KENT,	Truro, N.S.
ARCHIBALD, CHARLES,	Cow Bay, C.B.
AUSTEN, JOSEPH H.,	Halifax, N.S.
BAIRD, JAMES,	Joggins, N.S.
BELL, B. T. A.,	Ottawa, Ont.
BOYD, LUCIUS J., M.E.,	Halifax, N.S.
BROWN, R. H.,	Sydney, C.B.
CHAMBERS, R. E.,	Ferrona, N.S.
CLARKE, HOWARD,	Halifax, N.S.
COWANS, J. R.,	Springhill, N.S.
DAVISON, E. D.,	Bridgewater, N.S.
DIMOCK, C. H.,	Windsor, N.S.
FERGIE, CHARLES, M.E.,	Westville, N.S.
FRANCKLYN, G. E.,	Halifax, N.S.
GRAHAM, HARVEY,	New Glasgow, N.S.
GRAY, B. G., Q.C.,	Halifax, N.S.
GUE, T. R.,	"
HARDING, H. T.,	Truro, N.S.
HARDMAN, JOHN E., B. Sc.,	Oldham, N.S.
HAYWARD, A. A.,	Waverley, N.S.
HOLMES, HON. S. H.,	Halifax, N.S.
HOWE, C. FRED,	18 Arch St., Boston.
JENNER, EDMUND T. L.,	Sherbrooke, N.S.
KENNELLY, D. J.,	Sydney, C.B.
LECKIE, R. G.,	Londonderry, N.S.
LECKIE, R. G. E.,	Middleton, N. S.
LITHGOW, J. R.,	Halifax, N.S.
LITHGOW, WM.	"
MATHESON, W. G.	New Glasgow, N.S.
MONCKTON, G. F.,	Sherbrooke, N.S.

MOORE, W. B.,	New Glasgow, N. S.
MOSELEY, E. T.,	Sydney, C.B.
MACDUFF, GEO.,	Waverley, N.S.
MACKEEN, DAVID, M.P.,	Glace Bay, C.B.
MCDONALD, DUNCAN,	Truro, N.S.
McKAY, H. S.,	54 Devonshire St., Boston.
McLENNAN, J. S.	Bridgeport, C.B.
PARTINGTON, G. J.,	Whiteburn, Queen's Co., N.S
POOLE, H. S., F.G.S., &c.	Stellarton, N.S.
REID, J. M.	Musquodoboit Harbor, N.S.
RIGBY, CHAS. H.,	Glace Bay, C.B.
ROBB, D. W.,	Amherst, N.S.
ROBSON, ROBERT,	Victoria Mines, Sydney, C.B.
RUTHERFORD, J. G., M.E.,	Stellarton, N.S.
SJOSTEDT, ERNEST,	Bridgeville, Pictou Co.
SNOW, CHAS. L.,	Mabou, C.B.
STAIRS, JOHN F., M.P.,	Halifax, N.S.
STEMSHORN, H. G.,	"
STUART, GEO. W.,	Truro, N.S.
TUQUOY, D.,	Caribou, N.S.
TURNBULL, DEAN S.,	Killeag, N.S.
WILLIS, C. E.,	Halifax, N.S.
WILSON, B. C.,	Waverley, N.S.
WYLDE, H. M.,	Halifax, N.S.

On motion it was Resolved that the following gentlemen be elected Honorary Members of the Society.

#### HONORARY MEMBERS.

SIR WM. DAWSON, LL.D., F.R.S., &c.,	Montreal, P.Q.
HENRY Y. HIND, D.C.L.,	Windsor, N.S.
HUGH FLETCHER, B.A.,	Ottawa, Ont.
C. E. FARIBAULT, C.E.,	Ottawa, Ont.
E. GILPIN, JR., LL.D., F.R.S., Can., &c.,	Halifax, N.S.
ROSSITER W. RAYMOND, PH. D., &c.,	New York.

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In the afternoon a Committee of several members accompanied by counsel waited upon the Provincial Government in reference to the proposed legislation on Coal Royalty, and in view of the importance of the subject, the Council voted to publish the arguments of counsel and papers relating to the same in the Transactions.

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ARGUMENT OF MR. H. S. POOLE, M.A. A.R.S.M.

The united gold and coal interests sympathised with by the iron interests and represented by a Provisional Committee of the proposed Mining Society of Nova Scotia, appeared before the Executive Council, March 16th, at which meeting Mr. Poole contended:—

That the Government has issued three classes of coal leases:

1st. Those in accordance with original terms and with Section 102 of Chapter IX. of the Fourth Series of the Statutes.

2nd. Extended original leases with renewals nominally in accordance with Section 105, Chapter VII., of the Fifth Series.

3rd. New leases with modifications authorized by legislation of 1886 and subsequently.

That in the case of the last when it is proposed to increase the rate of royalty no question of "right" is raised.

The holders thereof can only pray for clemency and a careful consideration of the returns they receive for the outlay they may incur.

In the case of the second-class the holders contend they accepted the form of renewal offered by the Department of Mines in 1886 without investigation, naturally assuming that their full rights would be respected by the Crown officers and that they were unaware that other lessees were receiving forms of renewal more in accordance with their original leases; and they have reason to believe that the forms given to and accepted in ignorance by them were drafted without the knowledge of the Government or the opinion of the Attorney-General of the day.

The holders of the first-class contend that the proposal to increase their rate of royalty touches the sanctity of contracts.

That besides retaining their original leases, they hold re-



newals which are not new leases to be affected by the legislation of 1886 and subsequently (with one exception).

The original leases read that they are renewable "on the same terms, conditions and covenants as are contained therein"—with one exception the rate of royalty which the legislation could alter in *or* after 1886. That the Department of Mines has acknowledged that the lessees complied with the conditions, etc., required, and were entitled to a renewal on the same terms, conditions and covenant as in the original lease.

The contention hence is that the leases they hold are extended or renewed leases, not *new* leases.

Further that the whole spirit of a lease is to secure to the lessee on complying with certain conditions, a title good for a specific term of years on payment of a *maximum* rental or royalty; that a document reserving to the landlord the right to increase at will such payments would place him in the position merely of a "tenant at will," a position wholly incompatible with the expenditure a proper working of a coal mine in this country entails.

And this contention the lessees are ready to leave for trial in the courts of justice.

Holding this contention they are advised that the Legislature did act on their right, reserved in the clause of the lease, "Provided that the Legislature may revise and alter the royalty imposed by these presents in *or* after 1886 as they may think fit" when they amended the Act in 1885 and applied it in the renewals of 1886.

Having then altered the royalty in 1886, their right to alter the royalty after 1886 can only be exercised in the ordinary meaning of a "lease" with the lessee prior to each of the subsequent renewals contemplated in the original lease (the next being in 1906), but not during the current period of any term of renewal as now proposed by the Government.

Further that the late introduction of clauses into the Mines and Minerals Act reserving to the Legislature the power to increase *at will* the rate of royalty defined in future leases is arbitrary, and inexpedient, and is contrary to the true spirit of a

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lease to be made in the sacred name of Her Majesty the Queen ; but it also implies that the power (with justice) of the Legislature did not allow of such a contention being held prior to the passage of the amendments to the Act.

Lessees have contended that if the rate of royalty can be and is increased without a breach of faith on the part of the Legislature they will be at the mercy of the increasing necessities of the country entirely disproportionate to the extension of their industry and the returns they receive for their hazardous business. In reply they have been told the Government is willing to fix a maximum rate if the lessees agree, to which the counter reply has been made :—The leases now held on renewal state a maximum rate for the current period of renewal and to allow the justice of the proposed increase would be to acknowledge that the power of the Legislature had been used to override previous legislation on the faith of which large expenditures had been made and the good name of Nova Scotia was pledged ; and that if so used there was no guarantee that the maximum now (if) placed would be respected but that the same power might be subsequently exercised to again override this new maximum rate.

The lessees wish it to be clearly understood that in these contentions they regard the Government as a landlord of mineral rights entirely distinct from the Legislature with power to tax any industry, to repudiate contracts and confiscate property without indemnity.

They exceedingly regret that necessity has forced them to refer to this power and they have done so only because it has been impressed upon them by the Government of the day that this power lay with the Legislature, as it lay with the Local Government of Prince Edward Island to confiscate without indemnity the lands of absentee landlords (bills disallowed) and with the Quebec Government to modify the rate of interest on debentures (bill withdrawn).

The body of the lease reads :—“ The Company, their successors shall be entitled to a renewal thereof for such extended term, upon the same terms, conditions and covenants as are con-

tained in these presents, provided the Company are and shall continue to be *bona fide* working the area and complying with the terms, covenants and stipulations herein; and provided also that the Legislature shall be at liberty to revise and alter the royalty imposed by these presents in or after the year 1886 as they may think fit. Yielding the rent or royalty of six pence Halifax currency for every ton of coal of 2,240 lbs. except coal now known in the Province as slack coal and except coal to be used by the workmen of the Company or to be used in carrying on their operations which shall be wrought and sold or otherwise used and consumed.

And that the said Company shall keep one or more books of account wherein true entries shall be made of all such coal as shall from time to time be wrought or gotten forth and sold or otherwise used and consumed by the said Company, distinguishing in such accounts large coal from the said slack coal; and in case the entries do not so distinguish the large coal from the slack coal the whole quantity so far as applicable to the payments of the said royalties hereby reserved are concerned shall be considered as large coal.

The Committee further asks to have Sub-section (*e*) of Section 105 of Chapter 7 of the Revised Statutes, retained. It reads:—"In the cases of leases that are eligible for renewal in which the conditions of renewal embodied therein are different from those prescribed by this Chapter, and the lessees thereof are unwilling to have such conditions altered, the Commissioner shall have power to renew said leases on the terms contained therein and as prescribed by Chapter 9, Revised Statutes, Fourth Series, and no other."

They also request to have added to Section 113 of the present revision the words "prior to each period of renewal."

To have the words "or of any Act heretofore passed" of Section 116 struck out.

Also Section 122 omitted.

It was also contended:—"It is one of the conditions of the lease that "slack" coal separated from lump coal shall be exempt from payment of royalty."

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Hence that a landlord would not be justified in making the rate of royalty exclusively on run of mine coal except with the consent of the lessee.

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COAL ROYALTIES—ARGUMENT OF MR. HENRY AND  
DISCUSSION BEFORE COMMITTEE OF LEGISLATIVE  
COUNCIL.

Bill to amend the law relating to Mines and Minerals. Argument before the Committee of the Legislative Council, April 27th, 1892, in relation to the proposed increase of coal royalties.

MR. HENRY, Q.C.—Mr. Chairman and Gentlemen.—I appear before your Committee as counsel for a number of corporations who have invested capital in the development of the coal mining industry of the province, and who are actively engaged in that interest at the present time, as well as for a number of persons who are interested in areas which are not now being worked.

The questions involved in this enquiry divide themselves into two aspects,—first as to the actual rights of persons who have invested large amounts of money on the faith of the existing law of the province in relation to this matter; second, in respect to persons who are seeking to bring about the investment of further capital. These two classes are manifestly similarly and diversely interested.

The question may be regarded as almost exclusively a moral one; it is a question not so much of power as of propriety; it is a question not so much of what the legislature may enact, as of what it ought to enact or abstain from enacting.

I am limited to a very short time to discuss a large, and broad-reaching question,—a question affecting not only the interests, but the honor of the country, inasmuch as it affects the opinion that will be held abroad of the permanence of the rights of parties investing capital within the territorial limits of the province.

To confine myself within the short space of time allotted to me I must eliminate a good deal of matter which otherwise might properly be dealt with.



I begin, then, by calling the attention of the Committee to the fact that in 1873 there arose or came into existence a certain important right on the part of every holder of a lease of coal mining areas in the province of Nova Scotia, namely, the right expressed in the 102nd section of chapter 9, of the Consolidated Statutes of 1873. That right was expressed in the following words, which I will read :—

“ Lessees of coal mines in this province, their executors, administrators, and assigns, holding leases from the Crown, or from the Commissioner of Mines, made since the first day of January, A.D., 1858, or hereafter to be made, shall upon giving notice in writing to the Commissioner of Mines, at least six months previous to the expiration of such leases, respectively, of their intention to renew such leases, respectively for a further period of twenty years, from the expiration thereof, be entitled to a renewal thereof for such extended term upon the same terms, conditions, and covenants, as contained in the original lease, and in like manner upon giving a like notice, before the expiration of such renewal term, to a second renewal and extension of term of twenty years from and after the expiration of such renewal term, and in like manner, upon giving like notice before the expiration of such second renewal term, to a third renewal and extension of twenty years from and after the expiration of such second renewed term : provided that at the time of giving such notices, and the expiration of such terms, respectively, the said lessees, their executors, administrators, and assigns, are and shall continue to be *bona fide* working the areas comprised within their respective leases, and complying with the terms, covenants, and stipulations in their respective leases contained within the true intent and meaning of section 109 of this chapter ; and provided that in no case shall such renewal or renewals extend, or be construed to extend, to a period beyond sixty years from the 25th day of August, A.D., 1886.”

Now that comprises the whole of the legislative expression of the rights of the parties, under coal leases, from the day that law was promulgated. Speaking generally, it may be said that

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that section defined the rights of coal lessees in the province down to the present time, for, though in 1885 another Act was passed, it is submitted with every confidence that the Act of 1885, providing for the right on the part of the Legislature to increase or diminish the royalties from time to time payable by the coal lessees must be restricted in its operation to rights arising for the first time between the Crown and lessees after the passage of that Act. From 1873, down to the present time, every individual and every corporation interested in or holding coal areas under the law of Nova Scotia had a right to believe, and had a right to act upon the belief that they had an inalienable right to ask for an extension of time on compliance with the terms in section 102 just read, keeping and observing the terms of the then existing law. Neither the Act of 1885 nor the Consolidated Statutes of 1884, which modify the rights of lessees at that time, upon a true construction, amount to a giving to the Legislature by express provision of the power to do what is sought to be done by the bill now before the house. The bill now before the house proposes in no uncertain terms to subject the lessees of all the coal areas in the province, carrying on the mining of coal, to an increase of thirty-three and a third per cent. in the rental that they are now paying. It matters little whether the increase is 25 or 33 per cent., for if it would be discreditable, and I use the term with deference, to raise the rent contrary to the terms of the contract, the approbrium to be attached to the Act would not be measured by the amount of the increase. The proposal in the measure under consideration is to raise the rental of persons who had the right to regard their rental as being fixed thirty-three and a third per cent.; to impose upon them by an enforceable law of the province, without any right of objection on their part, an increase in their rent. It does not require argument to show that if it is wrong that A.B. should be given by force of legislative enactment the right to break his contract, it is equally wrong to give the Legislature the right to break their contract. In the one case the courts can give a remedy; in the other it depends upon whether there resides in the local legislature the power to

break its contracts. Probably it has such a power, but, if so, there is all the more reason why a high regard should be paid to the principles by which the rights of individuals are regarded as being secured and not to be dealt with upon a different principle from any others in a court of law. Now these parties had the right to go to the Government and get their leases renewed upon the same terms as before, a right which is common and perfectly familiar with regard to real estate. The Act before the house proposes to raise the rental thirty-three and a third per cent. We say that that is an Act which is unjustifiable. No amount of exigency in the financial affairs of any country would justify resorting to such a means of raising revenue as that. It reminds one of the way in which King John used to get revenue out of the Jews by pulling their teeth. I am serious in suggesting that if it is the case that these corporations had these legal rights, which must be regarded as sacred, and as constituting part of their personal property, it is not competent as a matter of legislative policy, even admitting the power of the Legislature, to take that property away from them, which is practically what is involved in this bill. Now let us see what the position of these companies is. Let me take one of them as an example. The Glace Bay Company held three leases granted in the years 1862, 1863, and 1865, respectively. These leases were outstanding and never surrendered, and they continued to govern the rights of the parties up to the year 1886. In 1886, by reason of the coming into existence of the law contained in the Fourth Series of the Statutes, to which I have already called attention, the Glace Bay Mining Company became entitled to receive a renewal lease upon the same terms with regard to royalty, as those contained in their original lease, which I may mention, for the sake of avoiding confusion, was six pence currency. But in the meantime this Legislature passed the Act of 1885 to which I must call the attention of the Committee for a moment. That Act provided that thereafter all leases should contain a provision providing for the right upon the part of the Legislature to increase or diminish the royalties from time to time. That is to be found on page 10 of

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the Acts of 1885. Now if that Act, according to its proper interpretation, should be held to be applicable to leases issued previous to the passage of the Act, instead of attacking the propriety of the bill now sought to be made law, we would have to go back and attack that section of the Act of 1885, as a deliberate inroad upon the rights of the lessees. But upon the true construction of the section, the courts would be bound to hold that the provisions of the Act of 1885 did not apply, except to leases issued in the future. That is, it did not apply to existing rights, but must be confined to contracts arising for the first time after the passage of the Act. The section reads as follows:—

“All leases of coal mines issued after the passing of this Act shall contain a provision that the royalties may be increased, diminished, or otherwise changed by the Legislature.”

If that section really applies to existing rights we have to admit that at that time a violation of the principles, the soundness of which will be admitted by every intelligent man, was committed. But we say that it was competent legislation, for it provided only for the case of corporations which should first become lessees after the passing of the Act, and we contend that it could not be held to effect the rights of parties under the existing law. Whatever question there may be as to the undesirability of making such a law, even as respects leases to be issued in the future, for the reason that such a power, subject to the whim of the Government, would be unsatisfactory to capitalists abroad, it must be admitted that, so far as the interests I am now advocating are concerned, there would be no invasion of existing rights.

Now, why does that clause not apply to existing leases? The language of the Act is:—

“All leases of coal mines issued after the passing of this Act.”

Now, at that time all the rights I am advocating existed. Some of them existed by virtue of leases long previously issued. All of them involved the right on the part of the lessees to get the renewals on the same terms that the existing



leases contained. Now, what would happen when the leases came to be renewed? There would be documents issued covering a new period of time, but which would be in reality nothing more than a continuation of the old period. These documents are called renewals. They are a restatement of the old conditions in a document which carries the provisions and rights of the parties over a new period of time; only that, and nothing more. Therefore, inasmuch as it is shocking to an ordinary sense of fair play to break a contract, even though it be broken by a legislature, the courts would beyond all peradventure hold that Act to apply to leases arising afterward; for to impute any other intention to the Legislature would be to impute the intention to break a contract. That would be something discreditable, and something which the courts would not impute if there was any other way of giving effect to the language. Inasmuch as it would be held to be discreditable in any legislature to seek to take away a vested right the courts would unquestionably construe the language so as to apply to new rights arising subsequently. That argument I need not elaborate, but I may say that we have in support of it the opinions of three or four lawyers, whose opinions have been sought without regard to politics, and who have all given it as their solemn and confident opinion that the language in the Act of 1885 does not mean that the Government shall have the right to impose new conditions with regard to royalties upon persons having existing rights coming forward and demanding renewals, which up to that time they had the right to demand. But even if in 1885 this Legislature committed itself to a course of action which savored of unfairness or oppression it does not follow that it would be justified in resorting again to a similar course now, but, if I am right, the Act under discussion undertakes, by force of legislative power, to affect the beneficial ownership of all these proprietors to a serious extent and involves a breach of public obligation; it involves the apprehension by people who have invested large amounts of money that contract rights are not to be respected in the Province of Nova Scotia. Parties may go to their friends

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and say that they hold leases of property on certain terms, and may induce them on the faith of such assurances to put in large sums of money, and then they may find themselves called upon to pay a different rent, and the enterprise instead of being a fairly promising one may become disastrous, and all on account of a breach of faith on the part of the people of the province, represented by the Legislature. If the Act of 1884 gave these people what I say it did this supposition is not improbable or extravagant. If it did not there is no argument for me to make. I challenge the promoters of the bill to show that from 1873 down to 1885 these people did not enjoy the rights I say they did. Of course our main contention is that this amounts to a legislative breach of contract and a deprivation of citizens and foreigners of actual existing rights by the instrumentality of an Act of Parliament.

THE CHAIRMAN—Your argument would involve the idea that no change could ever be made.

MR. HENRY—If a clear contract is made it does not make any difference how long a period it covers. The exigencies upon which it is proposed to break it must be great indeed. But let it be understood that while I, for one, am ready to admit that in the local parliament resides the power to cut down or impair or destroy private rights it follows as an incident to the existence of that power, that parliament must, by reason of the possession of such a power, be careful to see that it does not break faith with people lightly and bring the country into disrepute. I understand that the Government in promoting this bill disavow any intention of breaking contract rights, so we need not discuss the propriety of their doing that as a matter of legislative possibility.

MR. B. G. GRAY—The Chairman spoke about making a contract for all time. That is not the case here, as we have express limits in point of time. The contract is not for all time, but must terminate at a definite time. There is first a period of 20 years, and this may be extended by renewal to 40 years, but it comes to an end absolutely at the end of 60 years.

MR. HENRY—Section 105 of chapter 7, Revised Statutes, (5th series,) reads as follows :—

“The General Mining Association “limited,” and other lessees of mines other than gold or gold and silver mines in this province, their executors, administrators, and assigns, shall upon giving notice in writing to the Commissioner of Mines at least six months previous to the expiration of their leases, respectively, of their intention to renew such leases respectively, for a further period of twenty years from the expiration thereof, be entitled to a renewal thereof, for such extended term upon the same terms, conditions and covenants, as contained in the original lease, or as prescribed by this chapter, or by any Act that may be passed by the Legislature of this province, and in like manner upon giving a like notice before the expiration of such renewal term, to a second renewal and extension of term of twenty years from and after the expiration of such renewal term, and in like manner, upon giving like notice, before the expiration of such second renewal term, to a third renewal and extension of twenty years from and after the expiration of such second renewal term, provided that at the time of giving such notices, and the expiration of such terms respectively, the said lessees, their executors, administrators, and assigns, are and shall continue to be *bona fide* working the areas comprised within their respective leases, and complying with the terms, covenants, and stipulations in their respective leases contained within the true intent and meaning of section 107 of this chapter ; and provided that in no case shall such renewal or renewals extend or be construed to extend, to a period beyond eighty years from the date of the original lease, but the renewed lease shall not include in respect of each mine worked a larger area than five square miles.”

It is in this section probably that we are to look for the first attempt in any way to provide for a right on the part of the legislature to change the terms of tenure of leases of coal mines as contained in the leases. Sub-section (e) of the same section reads :—

“In the case of leases that are eligible for renewal in which

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the conditions of renewal embodied therein are different from those prescribed by this chapter, and the lessees thereof are unwilling to have such conditions altered, the Commissioner shall have power to renew said leases on the terms contained therein, and as prescribed by chapter 9, Revised Statutes, Fourth Series, and no other."

What happened in 1886, in connection with the renewals of the leases was this,—renewals were prepared which contained an express provision in the terms of the Act of 1885 with regard to the power of the legislature to alter, increase, or diminish the royalties, and these leases were accepted in a good many cases by companies, who either did not observe the peculiar wording of the leases, or who did not realize that it constituted a change from the preceding form, which is entirely different.

It will be necessary, in order to prevent confusion, to point out the substantial nature of the difference between these two forms, but at present I will content myself with saying that with regard to the language used in section 105, chapter 9, of the statutes of 1884, the most that can be said of it is that it purports by a general term to give power to change the terms of the leases so as to give the legislature power to increase the royalty. It may be said that the language is broad enough to include so extraordinary and improbable an intention, but even if it does do so it only gives power to the legislature to do a wrong, and it is still for the legislature to say whether in using language which might involve a matter connected with the general administration of the mines it was meant that the legislature hereafter should understand by the language used in 1884, that it was to have a right to exercise a power that would be otherwise a wrong. It is for the legislature and this committee to say whether under the power to change the terms of leases, they are to abstain from all question whether it is wrong to break a lease and to heap burdens upon these people, or to do a thing that is obnoxious to all notions of legislative policy. It does not advance the argument a particle to show that in 1884 there was a general power given to change the terms of leases. It may be that there



is good reason to interfere by changing the terms. The terms may be inconsistent with the general management of the mines, and it may be desirable on that account to change them, but there can be no cogent reason, except impecuniosity, which is no reason at all, for giving authority to raise the rent. We know that the subject of mines is one of public and general interest, and it may be that there is something in the terms of the leases which constitutes an obstruction to the exercise of the general policy, but no such reason can exist for raising the rental because it is necessary for the province to raise money from some source or other. This, I think, is a conclusive answer to the suggestion as to the meaning of the words in the Act to which our attention was called. With regard to the impropriety of making a man pay more for property upon which he has expended large sums of capital a humble illustration will suffice. Suppose that a man rents a farm upon which he grows potatoes only, and suppose that instead of paying so much an acre for the land he agrees to pay three cents a bushel for every bushel of potatoes that he raises, and that an agreement is entered into by which he is given the land on these terms for a period of 20 or 30 years. Suppose that on the faith of this agreement he goes into possession and erects houses, and barns and so on. After he has been working for ten years or so, his landlord comes to the legislature and says, "I am a little hard up. I agreed with so and so to let him have my place for a term of 20 or 30 years to grow potatoes, for which he was to pay me a royalty of three cents a bushel. He has been doing pretty well, and I think that now he ought to pay me six cents, or give up the enterprise." Will any lawyer, or farmer, or business man or miner say that there is any difference between changing the terms upon which people have invested in the heavy works involved in mining, by raising the rates of royalty, and the injury that would be involved to the man who undertook to raise potatoes, by violating the terms of his contract? I say that there is no contract to permit of such a change unless the reception, in 1886, of renewals which contained language that they were not obliged to be bound by, and

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their failure to realize that the language did them an injustice is to be regarded as the making of a new contract. I say that these people stand before the legislature to-day as they might have done in 1886, and say that they will accept no document which contains an assertion of a right on the part of the legislature to change the rent that they are to pay for mining coal in the areas leased. Possibly some of these corporations did receive leases in 1886 which contained words, which, if it is said that they are bound because they did not discover the meaning, would bind them as a matter of acquiescence and consent, but I do not think it can be seriously argued that the circumstances under which the renewals were given amounted to anything that, on a fair view of it, would be regarded as a conscious acquiescence in the use of this language to change the terms with regard to the rent.

Then I must point out why the companies did receive the leases. If some companies are not to be bound by the fact that they received the leases into their possession, other companies refused to receive them and took leases which are in the terms of the Act passed in 1886, to which I have not yet called attention. This Act contained a short provision at the end of one of its sections which gave the legislature by express agreement liberty to revise and alter the royalty in or after the year 1886.

Now it will be necessary to say a few words with reference to the condition of a company which refused to accept the lease with the language based upon the Act of 1885, but, instead, received a lease incorporating the language of the Act of 1866, to which I have referred. The majority of the leases received in 1886 contained the language provided for by the Act of 1866 and did not contain the language in the terms of the Act of 1885, expressly giving the legislature the right to increase or diminish the royalty from time to time. I refer now to the Acts of 1866, chapter 9, section 1, which is identical with section 102 of chapter 7 of the statutes of 1884, which gave the government the right to renew on the terms of the original leases. The two sections

are identical down to the last clause of section 1 of the Act of 1866, which reads as follows:—

“Provided that in no case shall such renewal or renewals extend, or be construed to extend, to a period beyond sixty years from the 25th day of August, A.D., 1886, and provided also that the legislature shall be at liberty to revise and alter the royalty imposed under such lease in or after the year 1886.”

That provision of the Act of 1866 was deliberately dropped in 1873. Various publications were issued by the department re-enunciating the law as constituted by the Act of 1873.

THE CHAIRMAN—Do you say that the leases which were not taken out under the terms of the Act of 1885 were taken out under the terms of the Act of 1866?

MR. HENRY—Yes; and this brings us to discuss for a short time the companies that have leases under the terms of the Act of 1866. Assuming for the sake of argument that they are bound by the terms of that Act, having insisted upon having those terms in their renewals, as distinguished from the terms offered to them, we come to the question, what right, or liability rather, is imposed upon that class by virtue of this language, which is the same as asking what is the meaning of the proviso in the Act of 1866. Bearing in mind that all these leases were to expire in 1886, which was solemnly and carefully provided for, and there was not a lease that did not expire in 1886, the purpose of the whole of the section is to provide what is to be done at the period of renewal. In that connection I will read it again. It is clear from this that 1886 was the time when the renewals were to take place if at all. The Act does not provide for any interference with the rental between 1866 and 1886. It is clear that the legislature was to have the right to make the change in 1886. *Quaere*—When did it commence to have that right? Does it not strike even a non-professional mind that the Act provided for the making of new terms for each renewal? That the change was to be made in 1886 if at all? At that period another tenure is entered upon for another period of twenty years upon terms which may be ruled upon by the legislature. Then in 1906 another term is entered upon when

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THE CHAIRMAN—Your argument is that the renewal is good for the 20 years?

MR. HENRY—Yes; and this view is concurred in in an opinion carefully prepared, after full investigation, by Mr. Borden, which the committee is at liberty to peruse. It is also the opinion of Messrs. Drysdale and Newcomb, especially I believe of Mr. Newcomb. If it is not felt that we have legal talent enough here it should be sought elsewhere. The view expressed by these gentlemen is the view that we say the court must take, and this is exceedingly important. The argument is easy to make and to understand. It is that taking the whole section together you find that the one thing to be done was to provide what was to be done in connection with the renewal of the relation of lessor and lessee, by a new document, the lessee having the right to demand a renewal, and the government being bound by the terms of the leases to grant it, but having the right to say what the rent should be. This right was not a right to interfere during the 20 years, but a right to fix the rent for the renewed period as it was fixed for the original period during which as it has been shown the legislature had no right to interfere.

Now, what happened? When these lessees took the renewals in the terms of the Act of 1866, they took the best thing that they could get, and we have to see what they got amounted to. The words of the Act were: "Provided also that the legislature shall be at liberty to revise and alter the royalty imposed." Is that a mere statement of the law, or does it give the legislature the power to alter the rate of royalty from day to day, and from year to year, and from time to time. I submit that it does not. The most that it means is the re-statement of the rights that the companies had. Admitting for the sake of argument that the companies are now liable to have the rate altered in the year 1906, they are not liable to have it changed before that time, and to do so would be a breach of contract.



We are willing to submit this point to any reputable judges. Therefore we cannot agree with the Provincial Secretary when he says that he does not intend to commit a breach of contract. The operation of the mines is often a boon to the province alone, while it is a source of loss to the people who put capital into the enterprise. A few cents a ton added to the freight will keep the coal from markets that it now reaches, while a few cents taken off will enable it to go further. The burden now proposed will not only impair the rights of persons who have now their money invested in the mines, but it will deter persons who have invested, or are desirous of investing in other enterprises. Surely in this enlightened age, morality and stability should be the governing considerations. If the proposed increase constitutes a breach of contract it will be a serious thing for the legislature to sanction it; if it be not a breach of contract we will have no right to complain on that ground, and it will become in that case a question of expediency, whether the enterprises can stand the burden proposed.

MR. H. S. POOLE, agent Acadia Coal Co., said that many of the companies were not present other than by representatives. (The Chairman stated that he had received telegrams from a number of companies authorizing Mr. Poole to speak for them.) The Premier and the Attorney-General had stated that they did not intend to use the power of the legislature to over-ride the terms of the leases, but claimed that they were acting within their powers as lessors. The holders of the leases desired to approach the committee as legislators and as landlords. The Attorney-General had said that he would blush if he thought that it was for a moment intended to commit a breach of contract in this legislation; he claimed that the government had the right to make the proposed increase. The Premier had impressed upon the holders of the leases the power of the legislature, and had said that it could take away private property. When it came to the question of property the holders of the coal leases received a good deal of sympathy from gentlemen representing other branches of the mining industry. There were present here

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representatives of iron, gold and quarrying interests, who all felt that the security of the titles to their properties was of vital interest to their shareholders. Touching the question of legislation they had been told that they had nothing to say but to appeal to the clemency of the legislature. He believed that there was a right of appeal to the Governor-General, and perhaps, to England. The Prince Edward Island legislature confiscated the lands of the absentee landlords, but when the appeal went home their action was disallowed, and a commission was appointed to indemnify the landlords, and the confiscation laws were disallowed. A year ago the Province of Quebec passed a mining law which included minerals not included here, phosphates, for instance. There was great agitation against the law and an appeal was made for its disallowance. A correspondence ensued which he had here. Sir John Thompson said that if the legislation was passed upon an admission, it should appear that the person making the admission had authority to do so. Mr. Sedgewick said that the law amounted to a confiscation of mining rights. In the end the province agreed either to withdraw the bill or modify it. In the province of Ontario they passed the Mining Act of 1892, giving certain rights and privileges to lessees, and at the same time imposing royalties, but they were particular to distinguish as to vested rights under titles previously granted. The increase proposed here would be of considerable moment to the holders of leases. As had been already intimated, if this law had been enforced last year the books of one large concern would have shown a debit instead of a small credit.

MR. LECKIE desired to state the effect that the passage of the bill would have upon the manufacture of iron. At present the coke used in the manufacture of iron was made from slack coal. Slack coal had been free because it was an inferior product and contained impure matter. By bringing slack coal under the operation of the bill, and imposing a royalty of ten cents a ton on it, it would make a difference to Londonderry mine in the furnace now going of \$9,000 a year. A rolling mill had been started to give employment to the men, and the increase there

would make a difference of of \$500 a year. This would be equal to a tax of \$9,500 a year on the Londonderry Company. There were gentlemen on the committee who were aware that for the \$3,000,000 expended by the Londonderry Company the shareholders had never received a penny of return. It takes two tons of slack coal to make one ton of coke, so that if the proposed royalty on slack coal is imposed it would amount to a tax of 20 cents a ton on coke, and this would be, as already shown, a tax of \$9,000 on the pig iron produced by the company. The rolling mill at present was carried on without loss, but also without profit. The imposition of the proposed tax would be \$500 of absolute loss to the company. The company had been discussing the propriety of blowing in another furnace. If that were done the loss would be \$18,000 a year. There never was a time when iron was as low as at present, and if the bill became law it would be a question whether the company would continue operations or not.

MR. FRANCKLYN concurred in what had been said. With regard to the bill providing for existing contracts he thought, with an exception which he desired to point out, that it would meet the substantial requirements of justice. This spring he was in Montreal, and made offers to the Canadian Pacific Railway Co. When he returned he found the notice of the proposed increase of royalty. The offer made the company, of course, could not be withdrawn. As the price of coal went down they had been obliged to accept a lower price. If they had not done so the company would have taken American coal, and the province would have lost the whole of the royalty. As the contract was practically made before the reception of the notice, he thought that the coal under the circumstances should pay the old rate.

MR. H. A. BUDDEN represented the Drummond Colliery. He said that it was usual to commence negotiations for contracts early in January. He was engaged for from six weeks to two months in such negotiations before the actual closing of the contracts. Contracts had been made by his company amounting in all to 100,000 tons, of which a large portion went to the Canadian

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Pacific Railway. Contracts had to be made early in order to engage the tonnage required. Buyers could not be forced to definite terms. If one company did not meet their views another would.

MR. J. R. LITHGOW, representing the Glace Bay Co.—While other companies holding leases prior to 1866 had the leases renewed the Glace Bay Company did not take out renewals in 1866, but held the original lease, under which, in 1873, the company became entitled to renew on the terms of the original leases. According to that legislation they were only bound to pay six pence per ton, old currency, on round coal and have slack coal free. This being the case it seemed like a breach of faith when the time came to give the renewals that they should not be able to obtain them. Suppose that in 1862 the province issued debentures bearing interest at 6 per cent., to terminate in 1886; and suppose that in 1873 the legislature enacted that the holders of those debentures should be entitled to renewals for periods of 20, 40 and 60 years at the same rate of interest. The consequence would be that the debentures would be increased in value. Suppose that ten years after the legislature should enact that the holders of the debentures should have the renewals, but only at the rate of 4 per cent. That would look like repudiation, but it seemed to him to be a parallel case. Or suppose that he leased a property for a period of 20 years at a specified yearly rental, and the landlord said that he might have a renewal for a further period of 20 years at the same rate. Then suppose that when the time came to renew the landlord said: "you may have your renewal, but you must pay an increased rental." That illustration was applicable to the present position of the holders of coal leases. They were entitled to renewals on the terms of the old leases, but the legislature said "you can have your renewals, but you must take the chance of what the royalty will be." He did not think that that was fair and he did not think that it would be sanctioned.

MR. POOLE—The Province of Quebec found that money could be borrowed at four per cent., and proposed to substitute debentures bearing interest at that rate for the debentures upon

which they were paying five per cent. The result was that they had not only to withdraw the bill, but the debentures of the province fell from par to 92.

MR. B. G. GRAY—Held three leases taken out under the statute which provided that the royalty was subject to revision and alteration. The legislation of 1885 changed those terms, and inserted a provision that the legislature might increase or diminish the royalty. In interpreting this legislation, where the terms used were different, it would held that the legislature must have intended something different. If the first terms were equivalent to the last, the legislature would not have found it necessary to make any change in them. He thought the terms first used did not mean the same thing as the other. If the royalty could be increased in the way proposed it could be increased every day in the week. He had contracts now current that had been made for six years. To "revise and alter" was a very different thing from to "increase and diminish." In order to encourage enterprise, the legislature might have intended, under the first terms, to give power to remit royalties for a number of years.

MR. POOLE read the following letter from F. H. Odiorne & Co., 86 State street, Boston :—

BOSTON, April 8th, 1892.

*H. S. Poole, Esq.*

*Acadia Coal Co.*

DEAR SIR,—Your favor of the 28th ult. was duly received. We found, when we had got the data of cost of coal from Pictou by all rail, our small customer here was not so anxious to use Acadia Coal as he had indicated, and he is not inclined to give us an order. We have this morning your favor of the 6th inst. The West End R. R. Co. have nothing to do with the purchase of the Ontario mine, although it is quite possible that some of the parties to that purchase may be stock holders in the West End Co., but that is no indication that the two operations have any connection. We find from Joseph Revere that the parties interested in both the Ontario and those interested with Hussey in the Inverness property are doing all they can toward the object which you seek.

The parties have a bond only for the Inverness property, and they have written to the Halifax people that they shall not purchase, but will surrender their bond in case the Government raise the rate of royalty. There can be no question but that such action by your Government will prevent the investment of American money in your mines, and greatly injure the credit of your Government in all other matters. We shall be very glad if we can see any way in which we can aid you in this matter.

Yours very truly,

F. H. ODIORNE & Co.

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The following is the opinion of Drysdale, Newcombe & McInnes, above referred to:—

## COAL ROYALTY LEGISLATION.

“ 35 NEW BEDFORD ROW,  
HALIFAX, April 6th, 1892.

DEAR SIR,—Referring to your conversation of yesterday with the writer, and to Mr. Clendenin's letter of the 28th ult., which we herewith return, we beg to say that it is our opinion, and we have no doubt that those words in your lease which provide “that the legislature shall be at liberty to revise and alter the royalty imposed by these presents in or after the year 1886,” refer only to the successive times for renewal, or possibly to some one particular time for renewal only to be selected by the legislature, and not to any time during the currency of the renewal terms. This construction appears to be very clear, having regard to the context, and the all important fact that the year 1886 was the time for the first renewal. It is further, the most reasonable construction with reference to the contract, and the rights with which it deals. It follows that the Government has not, as a matter of contract, the right to have at the present time a legislative revision of the royalty.

Yours truly,

DRYSDALE, NEWCOMBE & MCINNES.

*H. S. Poole, Esq.,*  
*Agent Acadia Coal Co.,*  
*Stellarton, N.S.*

“ I approve of and concur in the above opinion.

Also concurred in by B. G. Gray.

H. MCD. HENRY.”

## R. L. BORDEN'S OPINION.

Previously to 1866 the General Mining Association held certain leases from Her Majesty of coal areas in Nova Scotia.

By the Statute 29 Victoria, (Nova Scotia), Chapter 9, Section 1, it was enacted as follows:—

“ Lessees of coal mines in this province, their executors, administrators and assigns, holding leases from the Crown, or from the Chief Commissioner of Mines, made since the first day of January, A.D. 1858, or hereafter to be made, shall upon giving notice in writing to the Chief Commissioner of Mines at least six months previous to the expiration of such leases respectively of their intention to renew such leases respectively for a further period of twenty years from the expiration thereof be entitled to a renewal thereof for such extended term upon the same terms, conditions and covenants, as contained in the original lease, and in like manner upon giving a like notice before the expiration of such renewed term to a second renewal and extension of term of twenty years from and after the expiration of such renewal term, and in like manner upon giving like notice before the expiration of such second renewal term to a third renewal and extension of twenty years from and after the expiration of



such second renewed term, provided that at the time of giving such notices, and the expiration of such terms, respectively, the said lessees, their executors, administrators, and assigns, are and shall continue to be *bona fide* working the areas comprised within their respective leases, and complying with the terms, covenants and stipulations in their respective leases contained, within the true intent and meaning of Section 104, of the Act hereby amended, and provided that in no case shall such renewal or renewals extend or be construed to extend, to a period beyond sixty years from the twenty-fifth day of August, A.D., 1886, and provided also that the Legislature shall be at liberty to revise and alter the royalty imposed under such lease in or after the year 1886."

In the fourth Revision of the Statutes of Nova Scotia (R.S., 4th series, Cap. 9, Sec. 102), which came into effect in the year 1873, and in the fifth Revision, (R.S. 5th series, Cap. 7, Sec. 105), which came into effect in the year 1885, the provision as to increasing the royalties was altogether omitted from this Section.

In 1885 the Statute 48 Victoria, (Nova Scotia), Chapter 4, was passed. Section 4 of that Act is as follows:—

"All leases of coal mines issued after the passing of this Act shall contain a provision that the royalties may be increased, diminished or otherwise changed by the legislature."

In 1886 the lease granted to the Association expired, and all necessary conditions having been performed, renewals were granted. They were in the form marked "A" annexed hereto.

My opinion is asked:—

1. As to whether the word "leases" in the Statute 48 Victoria, Cap. 4, Sec. 4, includes these renewals.

2. As to the meaning and effect of the following clause in the form of renewal above mentioned: "Provided that the legislature shall be at liberty to increase, diminish or otherwise change the royalty imposed by these presents or renewals thereof, as they may think fit."

I am of opinion:—

1. That the word "leases" does not include these renewals but only includes original leases granted after the passing of that Act. The provision is expressly made applicable only to leases issued after its passage. If the legislature had intended to include leases issued before, but renewed after the passage of the

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Act, it would undoubtedly have expressed that meaning more plainly, *e.g.*, by using the words "a renewed" after the word "issued" in this Section.

2. I am of opinion that the words of this clause or proviso have strictly speaking no legal effect whatever. The legislature has power to increase, diminish or otherwise change the royalty and this provision cannot in any way affect that power.

If the lease is to be construed as if the word "lessor" or the words "Commissioner of Public Works and Mines" were substituted for the word "legislature," then a serious question does arise.

That question is this: Can the royalty be increased without the consent of the lessee at any time during the continuance of the term granted by the renewal, or can the power be exercised only on the occasion of a further renewal of the lease? In other words, is it intended to give the lessor power to increase, diminish or otherwise change the royalty on every day in the year during the sixty years, or only at the expiration of each period of twenty years, and upon the renewal of the lease.

I am of opinion that this provision must be read in connection with the provisions for renewal, and that if the word "Lessor" or "Commissioner" were substituted for "Legislature," the Commissioner could only increase the royalty on the occasion of a renewal.

This construction gives a reasonable effect and meaning to the lease. It gives the lessee a term of twenty years at a certain rent and the option of refusing to renew if the royalty be increased oppressively. It gives effect to every word of the proviso. It gives effect to the words "these presents," because the royalty thereby granted may require to be increased when the next renewal is granted. The word "renewals" is also required in order that the royalty imposed by any renewal may also be increased upon the occasion of a subsequent renewal.

Any other construction would bind the lessee to a contract of the most unreasonable and uncertain nature, and would place in the hands of the lessor extraordinary and unreasonable powers

of oppression. A lease of that character would be absolutely useless and valueless as an inducement to invest or continue capital in mining enterprises. Such a construction will not be placed upon the provision unless the words absolutely require it. And I think they do not so require.

I am also of opinion that the same construction should be placed upon the similar provision found in the form of lease marked "B" annexed hereto.

(Signed) R. L. BORDEN.

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PETITION TO HIS HONOR THE LIEUT.-GOVERNOR.

*To the Honourable Malachy Bowes Daly, Lieutenant-Governor of the Province of Nova Scotia:*

The petition of the undersigned lessees of coal mines in the Province of Nova Scotia,

HUMBLY SHEWETH:

That there has passed the House of Assembly and the Legislative Council during the present session of the Legislature of the Province of Nova Scotia, an Act entitled "An Act to Amend and Consolidate the Acts relating to Mines and Minerals."

The 116th, 117th and 122nd Sections of the said Act are respectively as follows:—

116. All ores and minerals (other than gold or gold and silver) mined, wrought, or gotten under authority of licenses or leases granted under the provision of said Chapter 7 of the Revised Statutes, 5th Series, or of any Act heretofore passed by the Legislature of this Province, shall be subject to the following royalties to the Crown for the use of the Province, that is to say,—

117. Coal, ten cents on every ton of two thousand two hundred and forty pounds of coal sold or removed from the mine, or used in the manufacture of coke or other form of manufactured fuel.

122. All leases of coal mines issued after the passing of this Act shall contain a provision that the royalties may be increased, diminished, or otherwise changed by the Legislature.

There has also passed the House of Assembly and the Legislative Council during the said present session an Act entitled "An Act respecting the Royalties on Coal."



The first section of the last mentioned Act is as follows:—

1. The royalty of ten cents per ton on coal as fixed by the said section shall be held to have taken effect on the 23rd day of February, 1892.

The present rate of royalty on coal is seven and one half cents per ton on all coal including so called slack coal, or in some cases nine and seven-tenths on round coal, such rates being optional on the part of the lessees and mutually regarded and treated as equivalent.

The first mentioned proposed Act provides in the said 116th section for an increase in the Royalty to be paid by your petitioners and all corporations or persons operating coal mines under existing leases, amounting to  $33\frac{1}{3}$  per cent.

The other proposed Act provides for the increased royalty being exacted retroactively, and it is submitted, is therefore specially objectionable independently of the grounds of objection to the main Act.

The previous legislation bearing on the said proposed Acts is as follows:—

Section 1, Chapter 9, of the Acts of 1866, is as follows:—

1. Lessees of coal mines in this Province, their executors, administrators and assigns, holding leases from the Crown, or from the Chief Commissioner of Mines, made since the first day of January, A.D., 1858, or hereafter to be made, shall, upon giving notice in writing to the Chief Commissioner of Mines, at least six months previous to the expiration of such leases, respectively of their intention to renew such leases respectively for a further period of twenty years from the expiration thereof, be entitled to a renewal thereof for such extended term upon the same terms, conditions and covenants as contained in the original lease, and in like manner upon giving a like notice before the expiration of such renewed term, to a second renewal and extension of term of twenty years from and after the expiration of such renewal term, and in like manner upon giving like notice before the expiration of such second renewal term to a third renewal and extension of twenty years from and after the expiration of such second renewed term; provided that at the time of giving such notices, and the expiration of such terms respectively, the said Lessees, their executors, administrators and assigns, are and shall continue to be *bona fide* working the areas comprised within their respective leases, and complying with the terms, covenants, and stipulations in their respective leases contained, within the true intent and meaning of Section 104 of the Act hereby amended, and provided that in no case shall such renewal or renewals extend, or be construed to extend, to a period beyond 60 years from the 25th day of August, A.D., 1886, and provided also that the Legislature shall be at liberty to revise and alter the royalty imposed under such lease in or after the year 1886.

Section 102, Chapter 9, of the Revised Statutes, 4th Series, (1873), is identical with the above section of the Act of 1866, except that it does not contain the concluding proviso, that is to say, the words "And provided also that the Legislature shall be at liberty to revise and alter the royalty imposed under such lease in or after the year 1866."

No such provision as this latter is contained in any part of the consolidated Acts of 1873.

Section 105, of Chapter 7, of the Revised Statutes, 5th Series, is as follows:—

105. The General Mining Association, Limited, and other lessees of mines other than gold or gold and silver mines, in this Province, their executors, administrators and assigns shall, upon giving notice in writing to the Commissioner of Mines at least six months previous to the expiration of their leases, respectively, of their intention to renew such leases, respectively for a further period of twenty years from the expiration thereof, be entitled to a renewal thereof for such extended term upon the same terms, conditions and covenants as contained in the original lease or as prescribed by this Chapter or by any Act that may be passed by the Legislature of this Province, and in like manner upon giving a like notice before the expiration of such renewal term, to a second renewal and extension of term of twenty years from and after the expiration of such renewal term, and in like manner upon giving like notice before the expiration of such second renewal term, to a third renewal and extension of twenty years from and after the expiration of such second renewed term; provided that at the time of giving such notices, and the expiration of such terms, respectively, the said Lessees, their executors, administrators and assigns, are and shall continue to be *bona fide* working the areas comprised within their respective leases and complying with the terms, covenants and stipulations in their respective leases contained within the true intent and meaning of section 107 of this chapter, and provided that in no case shall such renewal or renewals extend, or be construed to extend, to a period beyond eighty years from the date of the original lease, but the renewed lease shall not include in respect of each mine worked a larger area than five square miles.

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(e.) In the case of leases that are eligible for renewal, in which the conditions of renewal embodied therein are different from those prescribed by this chapter, and the lessees thereof are unwilling to have such conditions altered, the Commissioner shall have power to renew said leases on the terms contained therein and as prescribed by chapter 9, Revised Statutes, fourth series, and no other.

Section 4 of Chapter 4, of the Acts of 1885 is as follows:—

4. All leases of Coal Mines issued after the passing of this Act shall contain a provision that the Royalties may be increased, diminished, or otherwise changed by the Legislature.

All leases in existence previous to the 25th day of August, 1886, expired on that date, and were, with leases afterwards

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issued from time to time, renewable according to the terms of the Acts above set out and the terms of the leases themselves on the corresponding dates in the years 1906, 1926 and 1946.

Your Petitioners submit that the re-enactment in 1873 of section 1 of the Act of 1866, without the proviso under which the Legislature was to "be at liberty to revise and alter the royalty in or after the year 1886," conferred upon all the holders of then existing coal leases, and upon all subsequent holders of coal leases up to the year 1884, when the Revised Statutes, Fifth Series, were promulgated, an absolute legal right to renewals of their leases up to the year 1946 without any increase in rent or royalty.

As to section 105 of chapter 7 of the Revised Statutes, Fifth Series above set out, your petitioners are advised and they submit that in construing the portion of this section which provides that lessees "shall be entitled to a renewal upon the same terms, conditions and covenants as are contained in the original lease or as prescribed by this chapter or by any Act that may be passed by the Legislature of this Province," it must be assumed either that it was not the intention of the Legislature to provide for future legislative action in the shape of a measure purporting to legalize the imposition of an increased rent in violation of a lease defining what that rent should be, or on the other hand, if the language used as to the terms of renewal be considered broad enough to cover the matter of an increase of rent, then it is submitted that the Act itself was improper and that the present Act which proposes to legalize a specific increase of royalty in violation of existing contract rights should not receive your Honor's assent.

Further, as to this last mentioned section, your petitioners submit that even if upon its proper construction it would include a right upon the part of the Legislature to increase the royalty payable under then existing leases such increase could be stipulated for only at the time of the renewal in the year 1886 of the leases respectively, all of which were to expire and did expire in that year, so that the renewal being once made the royalty could not legally be increased until the next following renewal date.



As to section 9 of chapter 4 of the Acts of 1885 above set out, your petitioners are advised and they submit that upon its true construction it relates only to leases to be issued subsequently to its passing and that it does not relate to agreements merely expressing the rights of the parties by virtue of leases previously issued.

Your petitioners submit that there is clearly no legal ground for giving to the language here used an *ex post facto* operation, seeing that there is ample office for the words to perform in connection with original leases to be issued after the passing of the Act.

For the reasons above indicated, your petitioners submit that the proposed legislation in a most substantial and serious manner invades the vested rights of your petitioners secured to them by contracts solemnly entered into on the faith of which they have invested very large sums as capital in the various Coal Mining Districts of the Province.

By far the greater portion of such capital has been invested by persons residing outside of this Province and they as well as others residing in Nova Scotia would direct your attention to the breach of their contract rights which the proposed Acts involve as above set forth; and your petitioners therefore humbly pray your Honor to withhold your consent to the said Acts.

And your petitioners as in duty bound will ever pray, etc.

(Signed)

THE MINING SOCIETY OF NOVA SCOTIA.

Henry S. Poole, President.

THE GENL. MINING ASS'N, Ltd.

Cunard & Morrow, Agents.

THE ACADIA COAL COMPANY, Ltd.

Henry S. Poole, Agent.

THE INTERNATIONAL COAL COMPANY, Ltd.

By Hugh McD. Henry, their Atty.

THE CUMBERLAND RAILWAY AND COAL COMPANY, Ltd.  
By Hector McInnis, their Attorney.

THE CALEDONIA COAL AND RAILWAY Co.  
Per H. S. Poole.

THE GOWRIE COAL MINING Co'y, Ltd.  
By Hugh McD. Henry, their Atty.

J. R. COWANS,  
By Hector McInnis, his Solicitor.

J. R. LITHGOW, Treasurer and Manager,  
Glace Bay Mining Co. Ltd.

INTERCOLONIAL COAL MINING COMPANY.  
Henry A. Budden, Vice-President.

LOW POINT, BARASOIS AND LINGAN COAL COMPANY, Ltd.  
W. J. Stairs, President.

We, the undersigned, being interested as Lessees, Licensees, and otherwise in mines and mining properties other than Coal Mining Properties in the Province of Nova Scotia, having read the foregoing Petition, would beg respectfully to recommend the same to the serious consideration of your Honor.



PETITION TO HIS EXCELLENCY THE GOVERNOR-  
GENERAL IN COUNCIL.

TO HIS EXCELLENCY,

THE RIGHT HONORABLE SIR FREDERICK ARTHUR STANLEY,

*Baron Stanley of Preston, &c., &c.*

*Governor General of the Dominion of Canada in Council.*

The Petition of the undersigned lessees of Coal Mines in the  
Province of Nova Scotia,

HUMBLY SHEWETH :

That a Statute has been enacted by the Legislature of the  
Province of Nova Scotia, entitled, "An Act to Amend and  
Consolidate the Acts relating to Mines and Minerals," being 55  
Victoria (1892), Chapter 1. The said Act received assent on the  
30th April, 1892.

The 117th and 118th sections of the said Act are respect-  
ively as follows :

" 117. All ores and minerals (other than gold or gold and silver) mined,  
" wrought or gotten under authority of licenses or leases granted under the provis-  
" ions of said Chapter 7 of the Revised Statutes, fifth series, or of any Act heretofore  
" passed by the Legislature of this Province, shall be subject to the following royalties  
" to the crown for the use of the Province, that is to say :

" (a) Coal. Ten cents on every ton of two thousand two hundred and forty  
" pounds of coal sold or removed from the mine, or used in the manufacture of coke,  
" or other form of manufactured fuel."

" 118. All leases of Coal Mines issued after the passing of this Act shall con-  
" tain a provision that the royalties may be increased, diminished or otherwise changed  
" by the Legislature."

A Statute has also been enacted by the same Legislature  
entitled, "An Act respecting the Royalties on Coal," being 55  
Victoria (1892), Chapter 3. This Act also received assent on the  
30th April, 1892.

The first section of the last mentioned Act refers to section  
117 hereinbefore quoted and is as follows :



" 1. The Royalty of ten cents per ton on Coal as fixed by the said section shall be held to have taken effect on the 23rd day of February, 1892."

The first mentioned Act provides in the 117th section, for an increase of thirty-three and one-third per cent. in the royalty to be paid by your petitioners and by all corporations or persons operating coal mines in Nova Scotia under existing leases.

Your petitioners are advised and submit that the said sections hereinbefore set forth are contrary to the fundamental principles which should control the exercise of legislative power, and that they constitute a gross and unjustifiable invasion of the vested rights and interests of your petitioners; that said sections unwarrantably and inequitably violate and disregard the obligation of contracts solemnly entered into between Her Majesty the Queen, represented by the Commissioner of Public Works and Mines for the said Province, of the one part, and your petitioners of the other part, and if allowed to stand their effect will be to seriously impair if not destroy the confidence which should prevail in the continuance of rights granted by the said Province; and further, that not only do the said sections have the effect of so infringing vested rights and impairing the obligation of contracts, but by the last mentioned section such effect is declared to be retroactive.

The foregoing grounds of complaint against the said legislation are, it is submitted, upheld and justified by the following facts and reasons:

Your petitioners previously to 1866 held valuable coal properties in Nova Scotia under original leases thereof granted by Her Majesty. The rate of royalty reserved by such leases was sixpence per ton of 2240 pounds of round coal sold, slack coal being exempt from royalty.

By 29 Victoria (1866), Chapter 9, section 1, of the Acts of Nova Scotia, it is provided as follows:

" 1. Lessees of Coal Mines in this Province, their executors, administrators and assigns, holding leases from the Crown, or from the Chief Commissioner of Mines, made since the first day of January, A.D. 1858, or hereafter to be made, shall upon giving notice in writing to the Chief Commissioner of Mines at least six months previous to the expiration of such leases, respectively, of their intention to renew

“ such leases respectively for a further period of twenty years from the expiration thereof, be entitled to a renewal thereof for such extended term upon the same terms, conditions and covenants as contained in the original lease, and in like manner upon giving a like notice before the expiration of such renewed term, to a second renewal and extension of term of twenty years, from and after the expiration of such renewal term, and in like manner upon giving like notice before the expiration of such second renewal term to a third renewal and extension of twenty years from and after the expiration of such second renewed term, provided that at the time of giving such notices, and the expiration of such terms respectively, the said lessees, their executors, administrators and assigns, are and shall continue to be bona fide working the areas comprised within their respective leases, and complying with the terms, covenants and stipulations in their respective leases contained, within the true intent and meaning of section 104 of the Act hereby amended, and provided that in no case shall such renewal or renewals extend or be construed to extend to a period beyond 60 years from the 25th day of August, A.D. 1886, and provided also that the Legislature shall be at liberty to revise and alter the royalty imposed under such lease in or after the year 1886.”

In pursuance of the last mentioned Statute your petitioners, together with other coal lessees in the said province, procured renewals of their said leases. The rate of royalty reserved by such renewals was the same as in the said original leases, and such renewal leases also contained provisions for further renewals in the terms of the section last hereinbefore quoted.

All leases renewed under the provisions of the said last mentioned section, as well as all other coal leases issued in the said province previously to 25th August, 1886, expired on that day and according to the terms of the said section, and the provisions of the said leases, were renewable on that day, and on the corresponding dates in 1906 and 1926.

Your petitioners are advised, and they submit, that according to the true construction of the said last mentioned section, and of the said renewal leases, which contained provisions in accordance therewith, the rate of royalty thereby reserved could be revised only once, and that such revision could be made only at one of the renewal periods, namely, either in 1886, 1906 or 1926.

If such construction is not to prevail, then, adopting the construction most unfavorable to your petitioners, and assuming that several revisions of royalty are contemplated, it is obvious that such provisions could be had only at the renewal periods in 1886, 1906 and 1926, and at no other time or times.

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The fourth revision and consolidation of the public statutes of the said Province took place in 1873. Section 102, Chapter 9, of the Revised Statutes of Nova Scotia, fourth series, is identical with the above section of the Act, 29 Victoria, Chapter 9, (1866), except that it does not contain the concluding proviso, that is to say, the words "and provided also that the Legislature shall be at liberty to revise and alter the royalty imposed under such lease in or after the year 1886." No such provision as this is contained in any part of the said consolidation of 1873.

The following section (103) of said Chapter 9, Revised Statutes, fourth series, is as follows :

" 103. New leases in accordance with the provisions of this chapter may be executed to all parties now holding leases which will expire in the year 1886."

Your petitioners are advised, and they submit, having regard to the fact that the aforesaid section 1, of the Act 29 Victoria, Chapter 9 (1866) was re-enacted in the said revision of 1873, without the proviso under which the Legislature was to be at liberty "to revise and alter the royalty in or after the year 1886," that your petitioners and all other holders of then existing coal leases, as well as all subsequent holders of coal leases up to the year 1885, when the Revised Statutes of Nova Scotia, fifth series, were promulgated, acquired the absolute legal right to renewals of their leases without any increase of rent or royalty, or provisions for revising or altering the previous rent or royalty.

Section 106 of Chapter 7 of the Revised Statutes of Nova Scotia, fifth series, which came into effect on the 23rd April, 1885, is as follows :

" 105. The General Mining Association, Limited, and other lessees of mines other than gold or gold and silver mines, in this Province, their executors, administrators and assigns, shall, upon giving notice in writing, to the Commissioner of Mines, at least six months previous to the expiration of their leases, respectively, of their intention to renew such leases respectively for a further period of twenty years from the expiration thereof, be entitled to a renewal thereof for such extended term upon the same terms, conditions and covenants as contained in the original lease or as prescribed by this chapter or by any Act that may be passed by the Legislature of this Province, and in like manner upon giving a like notice before the expiration of such renewal term to a second renewal and extension of term of twenty years, from and after the expiration of such renewal term, and in like manner upon giving



“ like notice before the expiration of such second renewal term to a third renewal  
 “ and extension of twenty years, from and after the expiration of such second renewal  
 “ term, provided that at the time of giving such notices, and the expirations of such  
 “ terms, respectively, the said lessees, their executors, administrators and assigns are,  
 “ and shall continue to be bona fide working the areas comprised within their respec-  
 “ tive leases and complying with the terms, covenants and stipulations in their respec-  
 “ tive leases contained within the true intent and meaning of section 107 of this  
 “ chapter, and provided that in no case shall such renewal or renewals extend  
 “ or be construed to extend to a period beyond eighty years from the date of the  
 “ original lease, but the renewal lease shall not include in respect of each mine  
 “ worked a larger area than five square miles.

“(e) In the case of leases that are eligible for renewal, in which the conditions  
 “ of renewal embodied therein are different from those prescribed by this chapter,  
 “ and the lessees thereof are unwilling to have such conditions altered, the Commis-  
 “ sioner shall have power to renew said leases on the terms contained therein and as  
 “ prescribed by Chapter 9, Revised Statutes, fourth series, and no other.”

As to the said last mentioned section your petitioners are advised, and they submit that in construing that portion thereof which provides that lessees “ shall be entitled to a renewal upon “ the same terms, conditions and covenants as are contained in “ the original lease or as prescribed by this chapter, or by any “ Act that may be passed by the Legislature of this Province,” it must be assumed that it was not the intention of the Legisla- ture to provide for future legislative action in the shape of a measure purporting to legalize the imposition of an increased royalty in violation of a lease defining what the rent should be. On the other hand, if the language used as to the terms of re- newal be considered broad enough to cover the matter of an in- crease of royalty, then the Act itself was improper, and does not afford any justification for the subsequent action of the Legisla- ture in increasing the royalty in violation of existing contract rights.

Until 1885 the said royalty of sixpence per ton of 2240 pounds of round coal, continued to prevail as to all coal leases in the said Province.

Sections 1, 3 and 4, of Chapter 4, of the Acts of Nova Scotia, 48 Victoria (1885) entitled “ An Act to amend Chapter 7 of the Revised Statutes, fifth series, “ Of Mines and Minerals ” are as follows :

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" 1. Section 104 of the chapter hereby amended is repealed and the following substituted therefor :

" " All ores and minerals (other than gold, or gold and silver) mined, wrought or gotten under authority of licenses or leases granted under the provisions of said Chapter 7, of the Revised Statutes, fifth series, or of any Act heretofore passed by the Legislature of this Province, shall be subject to the following royalties to the Crown for the use of the Province, that is to say :

" " Coal. Seven cents and one-half of a cent on every ton of two thousand two hundred and forty pounds of coal sold or removed from the mine, or used in the manufacture of coke or other form of manufactured fuel."

" 3. Nothing in this Act shall compel lessees of coal mines in this Province to pay royalties on coal other than on the terms prescribed in the leases now outstanding, until said leases expire ; but any such lessee may take advantage of the provisions of this Act, from the date of its passage, if so disposed."

" 4. All leases of coal mines issued after the passing of this Act shall contain a provision that the royalties may be increased, diminished, or otherwise changed by the Legislature."

Your petitioners are advised, and they submit that in and by said sections 1 and 3 of 48 Victoria (1885), chapter 4, a revision of the coal royalties was made by the Legislature, inasmuch as slack coal, which was previously exempt from any royalty, was thereby made subject to a royalty of seven and one-half cents per ton, and the royalty per ton upon round coal was thereby reduced from nine and seven-tenths (equal to sixpence old currency) to seven and one-half cents. The average output of slack coal is from thirty to forty per cent. of the whole. The said revision was, however, declared by said section 3, to be optional with the lessees in respect of all unexpired leases.\*

\* Instead of this paragraph some petitions contained the following :—

" Your petitioners are advised and they submit, that in and by said sections 1 and 3 of 48 Victoria (1885), chapter 4, a revision of the coal royalties was made by the Legislature, inasmuch as slack coal, which was previously exempt from any royalty, was thereby made subject to a royalty of seven and one-half cents per ton, and the royalty per ton upon round coal was thereby reduced from nine and seven-tenths (equal to sixpence old currency) to seven and one-half cents. The average output of slack coal is from thirty to forty per cent. of the whole. The said revision was, however, declared by said section 3, to be optional with the lessees in respect of all unexpired leases.

When the time arrived in 1886, for the renewal of coal leases, a number of the outstanding leases were renewed in accordance with the option afforded by the last mentioned statute. Your petitioners, deeming it in their interest to maintain the previous rate of royalty, procured renewal leases reserving the royalty on round coal only at the said previous rate of nine and seven-tenth cents per ton.

Further, as to the terms and conditions of such renewals, your petitioners invoked the provisions of sub-section (e), section 105, Chapter 7 of the Revised Statutes, fifth series, hereinbefore set out, and obtained renewals of their said leases upon the terms in the said leases prescribed, and as authorized by said Chapter 9, Revised Statutes,

Your petitioners submit that during the debate in the House of Assembly, in the year 1885, upon the said Act, 48 Victoria Chapter 4, and previously to the passing thereof, it was distinctly declared by the member of the Government who introduced the said bill, and by the Premier of the Province, that the said bill was not intended to increase, but only equalize the rate or royalty. The Commissioner of Mines, who introduced the bill, said :

“ Now sir, the object of the Government has been to get as nearly as possible an equivalent rate to the present rate of nine and seven-tenths cents per ton—a uniform rate that will yield an equivalent revenue to the present rate.”

It was disputed that the rate of seven and one-half cents per ton on all coal would yield the same revenue as nine and seven-tenths cents per ton on round coal only. An amendment having been introduced exempting slack coal, the debate was thereupon continued as follows, by the Premier and by Mr. Bell,

Hon. Mr. Fielding said :

“ He did not think it reasonable to ask that slack coal should be exempted after the Government had based a figure on all coal. The bill in the main was satisfactory to mine owners ; the real difficulty that he saw suggested was, that the Government might be making a mistake and that they had not the necessary information. He was going to suggest that the bill might be passed with the provision that all leases issued should contain a stipulation that the royalties might be increased or diminished, which would leave the House free to make a change next year ; unless some such provision was made parties taking leases might complain.”

Mr. Bell said :

“ With the consent of the Hon. member for Cumberland, and on the understanding that such a clause would be added to the bill, he would withdraw his amendment.”

Upon the faith of the statements made in the said debate as to the intention and object of the provision in question, your petitioners, when the time arrived in 1886, for the renewal of coal leases, accepted renewals embodying said provision.\*

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fourth series, and not upon the terms or conditions otherwise prescribed by said Chapter 9 of the Revised Statutes, fifth series.

The renewals so obtained by your petitioners in 1886 did not contain any provision for increasing or diminishing the royalty based upon 48 Victoria (1885), Chapter 4, section 4, above set out, and it is submitted that that section is quite immaterial in respect to such leases.

\* Omitted from some petitions.



Your petitioners submit that in view of these declarations and other statements made by members of the Government of Nova Scotia, during said debate (which are set forth in the extract therefrom hereto annexed), it is inequitable and against good faith for the Government of said Province to claim or pretend that the said section 4 was introduced or passed, save for the purpose of making such an increase or decrease in the rate of seven and one-half cents per ton on all coal, as would produce an equivalent rate to the old rate of nine and seven-tenths cents per ton on round coal only. Your petitioners are advised that representations made by members of the Government during debate may not control the legal effect of a statute, but they submit that if such representations relating to the provisions of statutes affecting contracts with the Crown are to be lightly made, and as lightly repudiated or disregarded, the credit of the Province and of the Government thereof will be most seriously impaired.

Your petitioners are further advised, and they submit that the fourth section of said Act, 48 Victoria, Chapter 4, according to the legal construction thereof, relates only to original leases to be issued subsequently to its enactment, and that it does not relate to renewals, which are agreements merely expressing the rights of the parties by virtue of leases previously issued. There is, it is submitted, no legal ground for giving to the language of the section in question retroactive effect, seeing that there is ample office for the words to perform as applied to original leases to be thereafter issued. Moreover, Section 3 of the same Statute provides that "nothing in this Act shall compel lessees of coal mines in this Province to pay royalties on coal other than in the terms prescribed in the leases now outstanding until said leases expire."

The leases to which this petition refers were then in existence, and have been renewed, but have not yet expired. It is therefore submitted that those sections cannot be in any way invoked for the purpose of justifying the present legislative increase of royalty.

It follows, therefore, that a revision of the coal royalties having been made in 1885, which as to your petitioners took effect in 1886, the power of the Legislature, as a matter of contract, to further revise or alter the royalties was exhausted. But whether the Statute of 1885 is to be considered as effecting a revision of the royalties or not, the provisions of the statutes and leases are such as to exclude the right of the Legislature to make a further revision of the royalties previously, at least, to 1906. Both of these provisions have been disregarded in the enactments complained of, notwithstanding the fact that your petitioners and other holders of coal leases in the Province, many of whom reside outside the Province, have invested very large sums as capital in the various coal mining districts in the Province, upon the faith of the contracts so entered into by them, and upon the assurance thereby vouchsafed to them of a certain holding for a fixed rent.

Your petitioners are further advised, and they submit, that the imposition of such increased royalty upon coal under the circumstances hereinbefore set forth is contrary to the general policy of the Dominion of Canada, the intention of which has been to foster and promote the coal and iron industries of the Dominion by imposing a protective duty on coal, by removing the duty on machinery imported for the use of mining operations, and by imposing a duty upon pig iron imported, and granting a bounty upon pig iron manufactured in Canada. In the manufacture of such pig iron in this Province two tons of coke are used for each ton of manufactured iron. The coke so used is made in this Province out of the slack coal produced in the mines of your petitioners and others. The increased royalty of ten cents per ton upon that grade of coal therefore falls largely upon the producers of pig iron in the said Province, and thus increases materially the cost of its production.

Your petitioners are also advised and they submit that the legislation complained of is *ultra vires* of the Provincial Legislature, in that it affects trade and commerce by narrowing and controlling the scope of the coal trade of Nova Scotia with other

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Provinces, and also by seriously impairing the general trade relations of this Province so far as they depend upon honesty and fair dealing on the part of its Legislature.

Your petitioners therefore humbly pray that the said Section 117 of 55 Victoria (1892), Chapter 1, in so far as it relates to coal, the said Section 118 of said Chapter 1, and the said Section 1 of 55 Victoria (1892) Chapter 3, may be disallowed, or in the alternative that the whole of the said Acts may be disallowed, and your petitioners, as in duty bound, will ever pray, etc.

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*Extracts from the Official Reports of the Speeches of the Hon. Mr. Church and others, on a Bill to amend Chap. 7 of the Revised Statutes, Fifth Series, "Mines and Minerals," April 17th, 1885.*

HON. COMMISSIONER OF MINES—"As I understand the matter, Mr. Speaker, in the year 1826 His Majesty King George the Fourth granted to the Duke of York and Albany the mines and minerals of this province for the term of sixty years. This had the effect of preventing all other parties from leasing and working the mines of Nova Scotia. In 1857 the late Judge Johnston and Hon. A. G. Archibald, representing both political parties of the day, were sent to England to make arrangements, with regard to this matter, that might be more beneficial to the interests of the province. Their mission was successful, and as a result of their efforts Chapter I of the Acts of 1858 was passed, entitled, 'An Act for giving effect to the surrender to Her Majesty by the legal personal representatives of the late Duke of York and Albany, and by the General Mining Association and their trustees, of the mines of Nova Scotia, and to the lease of part of such mines to the said Association.' The effect of this legislation was that certain mining properties in the Counties of Pictou and Cumberland, and on the Island of Cape Breton, were reserved to the representatives above mentioned, now known as the "General Mining Association," and the remainder of the mines of the province were thrown open to general public competition. The General Mining Association received a lease which expires on the 25th August,



1886, and other parties coming in received leases, all of which expire on the 25th August, 1886. The royalty on coal in that chapter was fixed at the rate of sixpence, or ten cents old Nova Scotia currency, per ton, on what is known as round coal, that is, coal passed over a screen the bars of which are three-quarters of an inch apart. No royalty was charged on what is known as slack coal. As I understand, at that time slack coal was not of much value in this province, and hence the greater bulk of the sales was of round coal. The leases given to other parties were of the same character as that given to the General Mining Association, with a few exceptions, the royalty being payable on the same quality of coal and at the same rate; but the General Mining Association had the privilege of paying its royalties yearly in the month of March, whereas the others were liable to pay theirs quarterly. Now the difficulties in the way of fixing upon a rate arises from various causes. During the last few years a great deal of slack coal has been sold, principally during the last five years. This increase in the sale of slack coal has arisen from various causes. One is that a great deal appears to be used in the province for various industries, and a good deal is put into the manufacture of coke. Hence it has become an article of value. Also within the past few years, the system has grown up in some mines, notably the Springhill mine in Cumberland, of selling what is known as "run of mine coal," that is, the coal as it arrives at the mouth of the pit without screening it at all. Of course, in selling coal in this way, it is very difficult to get a proper return under the present system, which obliges the mine owners to pay a royalty of  $9\frac{7}{10}$  cents a ton, equal to 10 cents old currency, on screened coal. As the owners of the Springhill Mine sell so much run of mine coal they do not want to pay the same royalty that they might by law be obliged to pay, that is  $9\frac{7}{10}$  cents per ton on their total sales.

"A difficulty in fixing the royalty also arises from the fact that the relative amounts of slack and round coal differ in Nova Scotia and Cape Breton. The percentage of slack coal is much greater in Nova Scotia proper than it is in the island of Cape Breton. From careful statements made by officials in my department for a period of five years back, we find that the sales of round coal liable to pay royalty were, for Nova Scotia proper, 2,250,940 tons, and the sales of slack coal during the same period, 914,017 tons. In Cape Breton, during the same period the sale of round coal amounted to 2,317,704 tons, which shows nearly a hundred thousand tons more than Nova Scotia proper during the five years, while Cape Breton only sold during those five years 317,251 tons of slack coal, or nearly 600,000 tons less of slack coal than Nova Scotia proper sold. Now it will be very clearly seen that, on the coal sold during those five years, Cape Breton has paid more royalty than Nova Scotia proper, because she sold a much larger proportion of round coal, which alone paid royalty than Nova Scotia proper. From 1880 to the end of 1884 inclusive, Cape Breton sold of round and slack coal a total of 2,634,755 tons, and paid a total royalty during the five years of \$224,827.27. I have made a calculation which I vouch for as being correct, that this would give an average of  $8\frac{5}{10}$  cents per ton royalty on the coal sold from the total output of Cape Breton during the five years. Nova Scotia sold during the same period 3,164,958 tons of round and slack coal, on which she paid a total royalty of \$218,341.27, or  $6\frac{9}{10}$  cents and a fraction, say 7 cents per ton, while Cape Breton paid  $8\frac{1}{2}$  cents per ton as I have stated.

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"Now, sir, the object of the Government has been to get as nearly as possible an equivalent rate to the present rate of  $9\frac{7}{10}$  cents per ton—a uniform rate that will yield an equivalent revenue to the present rate.

"Our rate was ten cents a ton in former years, but by the Canada Currency Act, passed in 1868 or 1869, Nova Scotia currency was depreciated; so that  $9\frac{7}{10}$  cents present currency became the equivalent of 10 cents old currency. Hence in the fourth series of the Revised Statutes, instead of having the rate of royalty named at 10 cents as in the previous series, it was put down at  $9\frac{7}{10}$  cents. It might be argued that the province has been losing  $\frac{3}{10}$  of a cent on every ton sold since that time, and the Government might have based their calculation on a royalty of 10 cents instead of  $9\frac{7}{10}$ . But this matter was very fully considered and we thought that as this rate of  $9\frac{7}{10}$  per ton has obtained since the Currency Act came into operation, and that now a somewhat depressed condition of the coal trade exists, and as the outlook is not very promising at the present time, while the Government might fairly have adjusted the royalty on the basis of 10 cents, yet it would be said that we were placing burdens on the trade, tending to cripple its success, and therefore we based our calculations on the rate of  $9\frac{7}{10}$  cents per ton.

"The third sub-section says:—

'Nothing in this Act shall compel lessees of coal mines in this Province to pay royalties other than on the terms prescribed in the leases now outstanding until said leases expire, but any such lessee may take advantage of the provisions of this Act from the date of its passage, if so disposed.'

"As I stated a few moments ago, the present outstanding leases lapse on the 25th August, 1886. We provide by this section that the lessees of mines holding under leases now outstanding can take advantage of this Act, as soon as it becomes law, if they see fit; if they do not they will continue to pay royalty under the existing law until their leases expire; then, of course they will come under the provisions of this Act. There might have been no necessity for introducing this Act this session, were it not for the fact that there may be some new leases applied for between this date and next session, because, when the Revised Statutes, fifth series, become law, as they soon will, parties may come in for new leases. Another reason why it was deemed necessary to deal with the subject this session was, that under the provisions of the law, parties who wish to renew these outstanding leases are entitled to give six months notice to the department of their intention. That would give the department ample time to have all these leases renewed after next April, were it not for this fact, that there may be questions of forfeiture raised, questions involving the title to these areas and there may be long and tedious investigations taking weeks to settle. Consequently it was not deemed wise to defer this legislation till next session, but it was thought better to bring it down this year. I may say, Mr. Speaker, that I hope, in regard to any disputes that may arise, that the present holders may be able to renew their leases, and to carry on their works, but of course the Government will be obliged to carry out the law."

HON. MR. FIELDING—"I have not had much to do with the preparation of this Bill, which belongs to the department of my hon. colleague (Hon. Mr. Church), who had the principal share in its preparation. I believe that if it is not the wisest

solution, it is a solution of the question singularly happy to the mine managers. I received a note, and the Hon. Attorney-General and a member of the other branches as well, from a mine manager of Cape Breton, stating that 7 cents on the ton of coal sold would be a fair rate. When we put on  $7\frac{1}{2}$  cents I do not think it is objectionable. I am sure the mine managers of Cape Breton do not think this Bill unfair. I am informed that the manager of the Cumberland mines has telegraphed that it is satisfactory to him. The Government say 7 cents would suit these gentlemen, but it would not give us so much royalty as we now get; we say we will put on  $7\frac{1}{2}$  cents, which will give us the same revenue as before. Now when we have put on only half a cent more than the miners name, I think it must be satisfactory. There are three interests to consider: First, the Province, we get the same revenue; second, the interests of the mainland collieries, and we have shown that they are satisfied; at least the Cumberland Collieries; from conversations I have had with Mr. Leckie I am warranted in saying that; third, the Cape Breton collieries; the Associations say 7 cents, but the agent has said that  $7\frac{1}{2}$  cents is not objectionable to them. It seems to me, therefore, that the Bill protects the interests of all concerned: the Province gets the same revenue and the coal trade gets fair play."

HON. MR. CHURCH—"I wish to correct the hon. member for Inverness on one point. Seven and a half cents per ton, I said, would give a little more royalty than we received last year on the same output. I consider it fair to judge on the basis of an average of 25 per cent. of stock. Now there is no other convenient figure than  $7\frac{1}{2}$  cents unless we go down to 7 cents. A million tons would give, say, 750,000 tons of round and 250,000 tons of slack. Multiply 750,000 by  $9\frac{7}{10}$  and you have \$72,750 as the royalty that we would get from a million tons under the present system. Then take a million tons at  $7\frac{1}{2}$  cents and you have a product of \$75,000, the gain being simply \$2,250 on a million tons. That is very little. Now the object the department had was simply to get a uniform rate that would give the same revenue we are now receiving."

HON. MR. LONGLEY—"All were united in the opinion that there should be no tax on coal, but in our present financial circumstances it was not a policy which this Government could adopt to make any substantial reduction."

HON. MR. FIELDING said, "That if the effect of this amendment was going to reduce the revenue, then his hon. friend should move not only to reduce the tax on culm coal, but to raise it on other coal half a cent or a cent a ton. The hon. Commissioner of Works and Mines, in moving the second reading of the Bill, had stated that it would give about the same revenue as the old rate. If there was any doubt he presumed the hon. Commissioner had given himself the benefit of the doubt. He would strongly urge that no amendment be made which would reduce the amount the Province would receive. He thought it was generally admitted in the House that, however much we would like to see the royalty done away with, we could not now do it."

HON. MR. CHURCH—"He (Commissioner of Works and Mines) thought this Bill must either be passed in its present form, or else withdrawn and another introduced next year. The outstanding leases did not expire until 25th August, 1886;

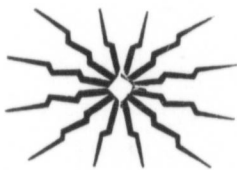


but there might be applications for new leases before that date, and the Government wanted to know what rate to put in new leases."

HON. MR. FIELDING said: "He did not think it reasonable to ask that slack coal should be exempted after the Government had based a figure on all coal. The Bill in the main was satisfactory to mine owners. The real difficulty that he saw suggested was that the Government might be making a mistake and that they had not the necessary information. He was going to suggest that the Bill might be passed with the provision that all leases issued should contain a stipulation that the royalties might be increased or diminished, which would leave the House free to make a change next year; unless some such provision was made parties taking leases might complain."

MR. BELL said that with the consent of the hon. member for Cumberland, and on the understanding that such a clause would be added to the Bill, he would withdraw his amendment.

HON. MR. CHURCH said that all the information the Government or the department had was included in the returns. The Government had no power to enforce any of the returns as regards the cutting of the coal, and he believed that it was no part of the duty of the inspector to pry into the accuracy of such returns. That was the difficulty in regard to an *ad valorem* tax. The only object the department had was to fix a rate that would be fair all around, and would give an equal amount of revenue to that now received from this source.



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TRANSACTIONS  
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PART II.

VOL. I.

SESSION 1892-3.

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The first Quarterly General Meeting of the Society was held in the rooms, 169 Hollis street, Halifax, on Friday, 17th June, 1892. The Morning Session opened at 10 o'clock. Among others present were: H. S. Poole, F.G.S., A.R.S.M., Acadia Coal Co., Stellarton; John E. Hardman, S.B., M.E., Oldham Gold Co., Oldham; Capt. G. MacDuff, Palgrave Gold Mining Co., Waverley; J. M. Reid, Oxford Gold Mines, Musquodoboit Harbor; C. E. Willis, Halifax; J. S. McLennan, International Colliery, Bridgeport; G. J. Partington, Whiteburn Gold Mining Co., Whiteburn; E. D. Davison, Bridgewater; T. R. Gue, Halifax; J. R. Lithgow, Glace Bay Mining Co., Halifax; H. A. Budden, Intercolonial Coal Co., Montreal; B. G. Gray, Halifax; Duncan McDonald, Truro; J. H. Austen, Halifax; George W. Stuart, Truro; Dr. E. Gilpin, Jr., F.G.S., Inspector of Mines, Halifax; Charles Archibald, Gowrie Coal Co., Cow Bay; Lucius J. Boyd, Waverley; Dean S. Turnbull, Empress Gold Mine, Beaver Dam; Howard Clarke, Halifax; W. G. Matheson, New Glasgow; G. E. Francklyn, General Mining Association, Halifax; H. M. Wylde, Secretary, Halifax; B. T. A. Bell, Editor *Canadian Mining Review*, Ottawa. Mr. H. S. Poole, President, in the chair.

The Secretary read the minutes, and presented the report of business transacted by Council since last meeting, which were confirmed.



**Amalgamation of the Gold Miners' Association.**

MR. JOHN E. HARDMAN, Oldham, moved, seconded by MR. J. S. McLENNAN: "That whereas by resolution passed on the 12th of May last, the Gold Miners' Association of Nova Scotia does hereby express its willingness to amalgamate with the Mining Society of Nova Scotia, under that name and title, to transfer to that society the assets, debts and lists of the Association, therefore be it resolved that the Mining Society of Nova Scotia does hereby accept the membership of the said Gold Miners' Association of Nova Scotia, with its assets, debts, property and list of members."

MR. H. M. WYLDE in answer to an inquiry, stated that there was a sum of \$65 in the treasury of the Gold Miners' Association with no liabilities worth speaking about. The resolution was carried unanimously.

**The Coal Royalty.**

THE CHAIRMAN—An important question coming up to-day for further consideration was that in respect to the recent levy of an increase in the royalty on coal. Possibly it may appear that this was a question affecting the coal members of the society only, and perhaps it might be better left in the hands of a sub-committee of the present meeting to discuss what steps should be taken regarding further action. Perhaps it would be necessary to approach the Governor-General in Council with a memorial praying for disallowance. It was a question which had not yet been decided by Council.

MR. G. J. PARTINGTON—The question, sir, is one which affects the whole mining community—the gold and iron and gypsum—as well as the coal operators. If the right of the Government was admitted in this instance, it might be extended and increased on the output of gold also. A discussion on the question might adduce some new points.

MR. C. ARCHIBALD—I quite agree with Mr. Partington that the matter affected the gold mining interests as well as the coal. A general discussion would enlighten the meeting, and the matter could then be committed to a sub-committee to report later in the day.

MR. J. S. McLENNAN—It would expedite matters if the sub-committee dealt with the matter first, and then made some recommendation or report, which could then be discussed by the Society. He would move that the chairman name such a sub-committee to consider the question and report at the afternoon session. The motion was carried.

THE CHAIRMAN named Messrs. McLennan, Budden, Archibald, Francklyn and Lithgow as a sub-committee.

**A United Mining Convention at Montreal.**

THE CHAIRMAN—Mr. Bell has, I understand, some suggestion to submit from the General Mining Association of Quebec.

MR. B. T. A. BELL—At a recent meeting of the Council of the General Mining Association of Quebec, a suggestion was made to hold a united mining convention at Montreal next year. With this object in view, negotiations had been entered into with the American Institute of Mining Engineers and other bodies, and replies favorable to holding such a convention had been received. The idea was to invite all the Canadian Associations to unite with the leading mining men of the United States in discussing such questions as mining legislation and mining practice. Papers on the mineral resources of the various provinces and their development would be submitted, and would doubtless do much to attract the attention of capitalists to Canada as a good field for investment. The order-in-council respecting the free admission of mining machinery not manufactured in the country would expire next year, and he thought that if a well directed move was made, this beneficial legislation might be renewed for another period. Our Association would be pleased to have the Mining Society of Nova Scotia, in conjunction with the other Canadian Associations, unite and co-operate in carrying out a programme for such a convention.

MR. JOHN E. HARDMAN—Speaking personally, I am heartily in favor of Mr. Bell's proposition. The question as to whether we should go as a representative body or as individuals might, however, be left in the hands of the Council.

MR. B. C. WILSON—It might be well to appoint delegates.

MR. B. T. A. BELL—The idea was not only to have a representative attendance, but also to have the Province of Nova Scotia represented by papers on its resources, mineral development, mining legislation, and such subjects of peculiar interest to itself.

MR. JOHN HARDMAN moved, seconded by MR. ARCHIBALD: That this Society expresses itself as favorable to the idea of a united convention, to be held in Montreal on or about the 23rd of February, and the matter be referred to the Council to report at the next Quarterly meeting.

The motion was carried unanimously.

#### New Members.

On the motion of Mr. C. E. Willis, Dr. Haley, President of the Newport Gypsum Mining and Manufacturing Co., Windsor, was elected a member, and Mr. Hugh McD. Henry, Q.C., was elected an associate member of the Society.

#### Revision of Constitution.

After some informal discussion on the classification of the roll of membership, it was resolved, on the motion of MR. HARDMAN, seconded by MR. MCLENNAN, "That the Constitution and By-Laws of this Society be submitted to a special committee, composed of the following members: H. S. Poole, J. E. Hardman, R. G. Leckie, B. T. A. Bell, G. W. Stuart, J. S. McLennan and the Secretary, for revision, and report thereon at the next Quarterly meeting."

#### The Society's Rooms.

MR. BELL said that it was very gratifying for the members to be able to meet to-day in the very comfortable and commodious quarters which their genial friend Mr. Gue had so thoughtfully provided and so generously furnished for their use; and he moved, with great pleasure, that the hearty thanks of the Society be conveyed to Mr. Gue. MR. STUART seconded.

THE CHAIRMAN expressed gratification that the Society was housed at present in such excellent quarters, and upon such excellent terms—freely and unostentatiously given. He had



much pleasure in tendering to their kind host the unanimous and hearty thanks of the members of the Society.

The meeting then adjourned until 2.30 p.m.

**The Coal Royalty.**

Messrs. Budden (chairman), Francklyn, McLennan, Archibald and Lithgow, the sub-committee on the coal royalty increase, met immediately afterwards and held a private session. Mr. Lithgow read extracts from a correspondence he had had with the Hon. W. S. Fielding, Provincial Secretary. Letters were read also by the chairman. The committee recommended that a memorial to the Governor-General-in-Council be prepared and presented to the Hon. the Minister of Justice at Ottawa, praying for the disallowance of the recent legislative enactment of the Nova Scotia Government in respect to the increased royalty.

**Afternoon Session.**

Members met at three o'clock, the President in the Chair. The sub-committee on coal royalty reported in favor of a memorial to the Governor-General-in-Council.

MR. C. ARCHIBALD said that the members of the Cape Breton Coal Miners' Association were willing to bear their proportion of the expenses incurred in thoroughly testing the increased royalty law in case the same should be taken to the courts, or in the event of any memorial being submitted.

MR. J. S. MCLENNAN moved that the report of the sub-committee be adopted.

MR. JOHN HARDMAN seconded the motion. Carried unanimously.

**Exhibits for the World's Fair.**

DR. E. GILPIN, Inspector of Mines, said that the Government had appointed an advisory board in connection with the Chicago Exhibition. The Government wanted to make the exhibit of the mineral resources of Nova Scotia as complete and representative as possible, and Dr. Saunders had informed him that they could have as much space as they required. It was also intended to be represented by an exhibit of their fisheries, forests and

fruit resources. He mentioned the latter in case any of the gentlemen present might have an opportunity of picking up exhibits. With regard to valuable gold specimens, he was afraid they could hardly expect specimens to be presented gratuitously for the purposes of the exhibition, but he thought some suitable arrangement might be made with the Government for the use of the same. He would be glad to have suggestions from the members, and hoped that the miners would all co-operate and do what they could to assist in making an exhibit that would reflect credit on the Province.

MR. J. M. REID—I have a few nuggets that are at the Government's service, provided it will guarantee their safe return.

THE CHAIRMAN—They will be insured by the Government.

MR. T. R. GUE presumed that proper precautions would be taken to insure their safety and safe return.

#### Mining Engineers to be Qualified.

DR. GILPIN, continuing, said there was a movement on foot by the Canadian Society of Civil Engineers to have a statute enacted whereby only qualified engineers should be admitted to practice. The matter was of great importance to the mining engineer and the mining community generally, and he suggested that the Society take some steps to help this matter along. In conclusion, he directed the attention of the Society to the remarks made by Mr. Hugh Fletcher, B.A., in his report for the members of the Geological Survey of Canada to the Civil Service Commission, having particular reference to a wider distribution of the Survey's reports and maps.

#### The First Crushing Mill in Nova Scotia.

MR. C. E. WILLIS pointed out that at Chizzetcook was to be found the first gold crusher used in Nova Scotia. The first method practiced of extracting the gold from the quartz in this Province was at Mooseland, where they made a hole in the ledge rock and used a pestle. The first mechanical mill was built at Mooseland. It was afterwards taken to Tangier, and is now at Chizzetcook, the property of Mr. Graves, of Boston. The mill

should be secured and preserved as a relic of the crude methods of working in vogue in the Province thirty years ago. It could be got at small expense. I have received permission from the officials of the Public Gardens at Halifax to place it there for safe keeping, if it can be obtained without any expense to the city. Mr. Partington, the agent of Mr. Graves, assures me that he can obtain the mill. The expense of placing it in the Gardens would amount to about \$25 at the outside. I would move that this Society assist in placing the mill in the Gardens as a permanent exhibit of the old methods of gold mining in Nova Scotia.

MR. G. J. PARTINGTON—I have great pleasure in seconding Mr. Willis' motion.

The motion was put to the meeting and carried unanimously.



*NOTES ON NOVA SCOTIA IRON ORES.*

E. GILPIN, JR., LL.D., F.R.S.C., INSPECTOR OF MINES FOR NOVA SCOTIA.

I do not pretend to claim any degree of originality for these notes, as I treated the subject in some detail in a paper recently read before the Canadian Institute of Civil Engineers. It occurred to me that as you had a paper on explosives, one on gold, and the names of two men prominently connected with coal mining were down on your list, I might complete the cycle by taking up the subject of iron ores.

Historically speaking, the history of iron ore mining and smelting in Nova Scotia, as well as in the Dominion, is a disheartening record of ill-advised starts and subsequent failures. A few exceptions stand out prominently. Bartlett, in an interesting paper published a few years ago, gives a succinct account of the progress of iron working in Canada, and many valuable statistics showing the amount of our imports of iron in its varied forms.

I may perhaps give a glance at the relative positions of the chief geological horizons recognized in the Province, in some one of which each of you is more specially interested. The differences of the more profound geologists as to the exact equivalents and ages of some of these rock masses need not be dwelt upon in this connection, especially as you will find that the geographical and geological relations of the iron ores are somewhat in unison. We have, therefore:—

The Modern, or surface soil.

*Trassic*, sandstone and trap.

*Carboniferous*, including permo-carboniferous, upper coal measures, true coal measures, marine limestone, lower or basal-carboniferous.

*Devonian*, Oriskany sandstone, etc.

*Upper Silurian*, Clinton, Lower Helderberg.

*Lower Silurian*.

*Cambro-Silurian*.

*Lower Cambrian*, Longmynd.

*Laurentian*.

All the above horizons carry iron ore, some in large amounts, others in quantities not yet recognized as of value, except the Lower Cambrian, the slates and quartzites of our gold fields. I have never been able to hear of any deposits of iron ore in them in any way promising to be of importance. The only occurrence of iron ore I have seen was a bed or seam about three inches wide a few miles west of Goldenville. It was a soft limonite, and may have been the result of oxidation of iron pyrites. Some of you who are more intimately acquainted with our granite and the gold-bearing strata may know of deposits of iron ore in them. The subject is interesting, for it is rare to meet so large a series of rocks abounding in many places in beds containing a good deal of ferruginous matter, and traversed by faults and foldings, not holding more or less segregated bodies of iron ore. Near Grand Lake there are some exposures of red hematite which were reported as belonging to the gold measures. Those that I saw were contact deposits between carboniferous conglomerates and grits and black slates belonging to the upper part of the gold-bearing rocks. In this connection I do not, of course, allude to the beds of bog iron ore which are not uncommon in the gold districts. The value of a good bed of iron ore on the Atlantic coast, within easy reach of shipping, would be considerable, and might be greater than that of some gold mines. It may be remarked that, as the auriferous rocks of the Province show little trace of fossils, the iron ore beds, if found, might prove comparatively free from phosphorus.

The bog iron ores which occur at numerous points in Nova Scotia in connection with the sites of swamps will prove of interest to our furnace men in the future. They are worked to some extent in Quebec for local furnaces. They are too low in iron and too high in phosphorus to be available for export, or

to be in demand for other than foundry purposes. Their method of formation is interesting as illustrating the aggregation of the sedimentary ores of iron in almost every age. Waters containing carbonic acid, dissolving iron from the strata they percolate by means of certain complicated combinations, deposit it again when they flow into water highly charged with vegetable matter. In some cases the result is only a sand charged with ferruginous matter, which will harden into a rock containing a few per cent. of iron. In other cases the resulting bed as now presented will contain a preponderance of iron, with percentages of silica varying from a minimum up to one rendering it valueless to the furnace man. An instance of this is met in Pictou County, where the bed is composed of fine grains of sand, each grain coated with iron oxide. At one point the coating of ore is so thick that analysis shows it to contain some 50 per cent. of metallic iron; gradually, from the richest portion of the bed, the coatings grow thinner, as it is followed right and left, until it becomes a ferruginous sandstone, and finally a coarse sandstone. These ores as met at Pictou County and at other points which have come under my notice, by some process in the alchemy of nature are usually free from phosphorus. When, however, the deposition of iron oxide took place upon a layer of sand or marl abounding in the "fossil" forms of the particular horizon, which may have been either an ancient lake or even a salt water bay, etc., not only are the casts of the fossils retained, but the ore is generally phosphoric. I allude here more particularly to the bedded red hematites of the Clinton, in Pictou County. At one time these beds may have been higher in grade over wider spaces than they are now, and it is easily credible that in the long periods that have elapsed since they were laid down they may in turn have been themselves subjected to the action of waters capable of leaching out some of their iron. The presence of small crystals and veinlets of quartz in them affords some proof of a process of replacement.

Passing for the present to the carboniferous measures, we notice that "clay ironstone" ores occur in all parts of it. I am not yet aware that they have been met in quantities to excite

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the cupidity of the miner. It is in the carboniferous marine formation, best known to the general public from its gypsum and limestone and good farming lands, and in the underlying or basal conglomerates or shales, that we meet our most interesting deposits of iron ore. In addition to the nodular layers of carbonate of iron there are, at two or three points, beds of the purer variety known as spathic ore.

As, for the purpose of this paper, the carboniferous may be considered the latest formed rock series of the Province, as well as one of the most extensive, it is evident that as it ranges through the country it must rest now upon one, now upon another of the earlier formed rocks. It thus occurs resting upon granite, Devonian, Silurian, Cambrian, Laurentian, etc., always, of course, unconformably. These junctions are always of interest to the student of field geology. You are probably all acquainted with the celebrated Gays River district. Here the conglomerates rest on the gold measures, with a layer of fine detritus between. At other points sandstones and shales rest on the older rock, like layers of plank and boards butting against a brick wall, or have the point of junction cemented with silicious, calcareous, or felspathic matter, and often fragments of the older rock abound in the newer along the plane of contact. When limestone forms the later rock the passage from the pure limestones to the slates is often gradual.

It will be readily understood that these lines of junction form natural highways for the passage of underground waters. These waters, governed by no law we are cognizant of, frequently exert their powers to give us junction deposits of iron ore. A glance at the contact deposits of Pictou County will serve as an example of the limonite deposits. Here the marine limestones come, at many points for considerable distances, in contact with Silurian slates. Evidently denudation has swept away many feet of measures, a process hastened by the access afforded to water by the planes of contact, and by the lines of faulting which frequently characterize newer rocks at their junction with older strata. As this went on the particles of iron ore gathered from the older slates, as well as from the carboniferous strata, were

accumulated at every opening. As the limestone was moved it was either replaced by the iron oxide or the channels of the water currents were filled with it. In the Whitehaven district in England there are many interesting examples of the replacement of masses of carboniferous limestone by iron ore, and of the filling of channels and crevices by the same means.

So complete, and, if I may use the words, "so carefully conducted" has been the replacement of each particle of limestone by one of iron ore, that the lines of bedding and the fossil remains have been preserved. This melting down of great masses of limestone, and accumulation of bodies of limonite, is well illustrated in Pennsylvania, in some of the Silurian limestone districts.

In the case of the contact deposits between the basal carboniferous conglomerates and the older rocks, the process has presumably been somewhat similar. These ore bodies are often irregular and thicken or thin out rapidly. The thicker bodies represent perhaps the line of most decided action, and the points where the boulders of felsite, granite, slate, whin, etc., were removed and their place filled with iron ore. As the attention of the miner is turned from the main body of the ore he finds that while perhaps a thin seam follows the line of junction, the power acting on the conglomerate has become weaker. The ore when broken shows inclusions of rock; gradually the percentage of more or less changed rock grows greater, until only the surface of the boulders has been transformed into ore; finally the only indication left is the replacement of the original silicious or calcareous bond of the pebbles by one of iron oxide. Often the process has not advanced beyond a thin film of ore at the point of junction, or a coating of the boulders. I think I am correct in saying that the limestone contact formations here are limonites, often varying in their water contents, and sometimes manganiferous, while the contact deposits marking the basal carboniferous rocks are hematites. This, presumably, is merely due to greater age and slight metamorphic action.

Descending once more in the geological scale, the next notable deposits are the bedded hematites, sometimes magnetic,

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of the Laurentian limestones, as met at Whyhogomah and East Bay. There are always conflicting theories with regard to the modes of formation of every mineral deposit in this wonderful horizon, and I will not detain you beyond remarking that to the miner these deposits appear in their ore contents, relation to surrounding rocks, etc., to resemble closely those of Pictou and Annapolis counties, always called "beds," and to suggest their having been formed in a somewhat similar manner.

The vein deposits of limonite at Londonderry and of specular iron ore at the East river, Pictou county, appear to have accumulated in a fracture running with the general course of the strata, and to have been accompanied by replacements of country rock by carbonates of iron, lime and magnesia, and more or less secondary segregations of iron ore.

This brief and imperfect glance over the classes of iron ore presented in Nova Scotia may prove interesting to the miner as well as to the geologist and the student of mineralogy. The miner, whose interest it is to extract the best ore at the cheapest rate, need not concern himself with the disputes of geologists, but he must thank them for the classification of the facts gathered by many generations of his predecessors. His outlays on junction deposits must be more carefully made than in bedded deposits; his preliminary work more particularly directed to proving ore in advance; his attention directed to the variations in quality due to the modifying effects on his ore of the different strata it was influenced by during the process of formation. When mining the bedded deposits he must be guided by the motto, "All that glitters is not gold," for the grade of his ore and its sulphur and phosphorus contents continually vary. Still he has the advantage of a longer stretch of reasonably assured regular workings. If he is to win ore from a vein, the skill of his foreman and their unremitting study of the working faces have to be invoked to assist him in laying down the best rules for following leaders, slips, and for meeting the host of curious changes every vein shows as it is followed.

As I feel that this rambling paper, which was designed to provoke discussion, has reached its limits, I will close, with the



hope that all members of the Association will give it the benefit of the curious or anomalous phenomena they meet in their mines, for brief notes on such points are very valuable from the discussion following them.

Discussion.

MR. JOHN HARDMAN wished to know whether the deposit of iron ore at Grand Lake was red or brown?

DR. GILPIN—It is a red hematite.

MR. HARDMAN—Is it silicious?

DR. GILPIN—Yes.

MR. WILLIS said that about four years ago he was down at Lockport, and on the beach, and for a mile along the shore he found masses of brown hematite ore. It is a granite formation. Evidently there was a large deposit of brown hematite in that vicinity.

DR. GILPIN—I was going to say that boulders of brown hematite are not uncommon about Bedford and Sackville.

THE CHAIRMAN suggested that they might have drifted from Lake Rossignol.

DR. GILPIN—It would not be further than from Londonderry, or from Truro, and boulders of limonite are not uncommon about Bedford and Sackville, presumably derived from these localities.

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*ON THE INTRODUCTION OF NEW EXPLOSIVES FOR  
COAL GETTING IN NOVA SCOTIA.*

BY H. S. POOLE, A.R.S.M., F.G.S., STELLARTON.

The selection of the writer to present to this Society a paper on the introduction of new explosives in our coal mines has been solely made because in the pits under his charge there has been a larger consumption of the so-called flameless explosives than elsewhere in Canada.

He has nothing new beyond the practice in question to speak of, and the following notes have been put together with that understanding.

The quantity of inflammable gas met with in several of the pits of Pictou County, early pointed to the extra danger there attending the use of ordinary blasting powder, and led to the drafting of strict rules governing the firing of shots in coal long before mining legislation made similar precautions compulsory. Until lately, when from the free evolution of fire-damp in any workings the risk accompanying shot-firing seemed excessive, the only alternative open to the miner was to abandon powder altogether and fall back on "mall and wedge."

But in Europe the possibility of preparing explosives making less flame than powder, engaged the attention of chemists for many years, and met with marked success. Recent legislation has forced this foreign experience on the notice of all our coal operators, in consequence of the undoubted additional risk that has been proved to attend the use of common powder in pits of a certain character. It is not proposed to follow step by step the enquiries made by royal commissions in Prussia, Austria, France and England, nor to refer to the various compounds

which seemingly can be used as substitutes for powder in coal getting. The several reports or summaries of them, have been given in colliery periodicals.

Some four years ago no explosives of this new class being then available in this country, shot firing stopped in the Acadia pit at Westville, and shortly after powder was also given up in the adjoining Drummond mine on the same seam. As yet in the former no other explosive has been introduced, the coal working freely under the pressure entailed by the depth of cover, now some 1,500 feet vertical, over the levels of the eighth lift. At the time the use of powder was abandoned in these pits attention was drawn to the advantages and decreased risk accompanying the firing of shots in Germany with such a compound as carbonite, though the difficulties of importation then barred its adoption in this Province.

Trials, however, were made with blasting gelatine and water cartridges, which, though flameless, did not seem to promise satisfaction in pits where the character of the coal required a large number of shots to be fired each day, say three in each working place each shift. It was found, so slow was the process of tying each charge in its bag of water, that in such a pit as described an army of shot-firers would be necessitated; besides it was felt in the desire to hasten the preparations that a comparatively large percentage of shots would undoubtedly lose the water envelope and hence might show flame; besides, the size of hole the water cartridge required was another objection. Previously, it should be added, an attempt was made at Sydney mines to bring down coal with lime, but it was not proceeded with.

Later on the Acadia Powder Co., with works at Waverley took up the question of flameless explosives and prepared several samples. These were practically tested in the Vale pit in April, 1890. When fired under confinement they all proved flameless, even when the stemming was blown out under conditions that with powder would have produced an abundance of flame. The work done by these samples was, however, irregular, and the detonation sometimes imperfect—to remedy which defects further experimenting was necessitated. In the meantime a

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local company started at Halifax the manufacture of roburite, the best known preparation of its class in use in England. But before relating in detail the experiences connected with the practical application of these two compounds supplied by the Roburite Company and the Acadia Powder Company, a few remarks of a general character on the subject of explosives may interest men, who, like the writer, had not previously given the matter attention.

At the same time it is proposed to mention in a very summary way the theoretical grounds for believing black powder should be excluded from certain coal mines.

All engaged in coal mining are aware that the workmen with one voice contend that there is no blasting material to compare with powder for bringing down coal; nor is this preference confined to colliers. Mining engineers of repute are also to be found who insist that for certain strata no other explosive can touch powder. This view has been put down to prejudice, especially, by the champions of new compounds, who may be as positive as their blasting experience is limited, and it may be worth while to consider whether these practical men have any theoretical ground in favor of their contention.

To those familiar with explosives, much that is here given will necessarily appear very rudimentary, but possibly to others the points that were found of interest to the writer may also prove so to them, now especially when legislation brings into disrepute gunpowder without offering to explain why it is considered more dangerous than some other materials of similar nature.

The Cape Breton miner who knows that in his County some 19,000,000 tons of coal have been won by the probable consumption of some 1,500 tons of powder without the occurrence of an accident involving the lives of as many even as three men, cannot see wherein lies the danger that is in excess of other sources of accident to which he knows he is exposed. The additional risk, which long immunity has shown to be fractional, he is willing to take, especially as in efficiency, cheapness and convenience, a change from powder, so far as he knows, is not for the

better. He knows that dynamite and its allies are too quick in action, shatter the coal too much, and make a larger percentage of small coal than powder which brings down more coal shot for shot, and rends away from the face the coal in larger masses by its progressive action. The special danger attending the use of powder has not as yet, fortunately, shaken his nerves, so to find the necessary experience we have to look at the mines of Cumberland and Pictou Counties. In these counties inflammable gas is often freely evolved and the roadways and walls of the working places covered with a fine dust, noticeably worse in cold than in warm weather; and where these conditions exist a blown-out or "gunned shot," emitting a stream of flame and sparks a distance, it may be, of six or eight yards, has a very ugly look and suggests the worst of possibilities.

Prior to Nobel giving to the world his investigations with nitro-glycerine, which revolutionized the manufacture of explosives, the mixtures generally employed were all of one class, combustible as gunpowder, and composed of substances that have so strong a chemical affinity that they combine and generate gases with rapidity on the application of heat. Under confinement, this sudden evolution of gases causes explosion, but unconfined there is rapid combustion only.

In the manufacture of powder for different purposes, changes have been made in the relative proportion of the ingredients, in the purity of the materials, in the size of grain, and in the substitution of substances chemically equivalent—the latter often to cheapen the production, as in the substitution of nitrate of soda instead of nitre. The remarkable influence in the quality of the charcoal used was early noted, certain woods furnishing superior charcoal to others, but the greatest stride in this direction was in the adoption of some straw fibre, and that imperfectly carbonized. At least it is reported that cocoa powder largely owes its exceptional efficiency to this innovation, although of course rival manufacturers who sought to discover its composition had no difficulty in at once noting that it contained an unusually small percentage of sulphur, 3 per cent. only, while the ordinary mixture in gunpowder ranges near 10 of sulphur with

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15 of charcoal and 75 of nitre. Whatever may be the composition of cocoa powder, the change made has given it a *progressive* quality at the moment of explosion not attained by any previous mixture.

The better to understand the theoretical source of danger attending the use of powder, it may be well to consider the experience gained in the study of the relation of powder to guns for military purposes and see wherein it applies to the question before us. To begin with, it is necessary to distinguish between the ignition and the total combustion of powder; to note the rapidity with which the heat resulting from the burning of one grain spreads the conflagration to adjoining grains, and the entire consumption of each grain. Thus it is found the larger the grain the quicker the ignition, but the slower the combustion. This property is taken into consideration in the preparation of powder for different purposes, and explains why small-grained and mealed powder are used in fireworks and large grains in cannon proportionate to the length of the piece. In the former the communication of burning from grain to grain is purposely made slow, although the total decomposition of each grain, being small, is soon effected.

For military purposes, to obtain a continuously increasing propulsive force that will develop a low trajectory, the rapidity of combustion of powder has been regulated by the composition, the relative percentages of the ingredients in the mixture, as well as the size and shape of the grain.

For guns of different sizes special powders are prepared, the size of the grain varying with the object of producing initial pressures at the breech of the gun as low as possible, at the same time maintaining a progressive action behind the projectile as far as the muzzle without the expulsion of unconsumed powder. The most modern form of large grain is understood to be a pierced hexagonal prism. Although powder has been so long known, a great improvement has been effected in its efficiency within the last twenty years. Instead of imparting to the projectile an initial velocity of 1,500 feet per second as a maximum, a flight at the rate of 2,500 feet per second has been



attained of late; at the same time the internal pressure exerted by the explosion of a charge in the gun has been diminished from 20 to 13 tons per square inch.

For mining purposes, where a progressive action is desirable, as in rending down coal, the size of the grain of powder has something also to do with success; and the quantity of powder used should be proportioned to the depth of the hole and the work to be done. But the object the miner desires to attain differs somewhat from that of the artilleryman; the one looks to expel the stemming without fracturing his piece, the former to cause the tight tamping of the stemming to rupture the breech of his *gun*, and this disruption necessitating a new bore-hole for each shot, debars him from experimentally proportioning his charge so as to avoid the expulsion of some unconsumed but ignited grains of powder into the atmosphere. It is this emission of ignited but unconsumed grains that is so dangerous in the case of dry and fiery mines. There is also in the explosion of powder a large amount of heat evolved, which further expands the gaseous product of combustion and also projects into the atmosphere the solid residue at a high temperature. An additional objection to the use of powder in a dry hole occurs when the coal dust is left in and adds to the inflammable material. The combustion of this excess of carbon is imperfect, and produces the deadly carbonic oxide, which, when heated, burns in contact with the oxygen of the air, and generates more heat. For a time in England a compressed form of powder has been found convenient, but for the reasons stated above it is considered somewhat more dangerous than the ordinary form.

Having shown some of the sources of danger attending the use of gunpowder in fiery pits, we have now to consider in what direction safer explosives have been sought. More or less success was found to attend the mining or enveloping of high explosives with salts, such as alum, that contain a large percentage of water of crystallization. The earlier Prussian and Austrian commissions recommended the admixture of carbonate of soda. Soda-wetter-dynamit contains 40% carbonate of soda and 60% of dynamite; its explosive force is low, and it freezes at 45°

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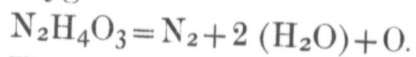
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Fahr.; and what is worse, at a temperature of 95° Fahr. it loses water of crystallization, which causes the nitroglycerine to exude.

Partial success was attained with wet moss as stemming. Then it was shown by experiment that dynamite and other high explosives did not give a flame if the stemming exceeded 16 inches, but that with less they gave a flame that ignited gas; so again, when dynamite is burnt it will ignite fine coal dust, but when exploded no combustion takes place. Other experiments showed dynamite alone would not fire a 5% mixture of gas and air, but would fire one of 8%. One great objection to carbonate of soda is that this salt is inert, so that when ammonium nitrate was substituted, a great step in advance was taken, for it is explosive besides possessing other advantageous qualities; its temperature of detonation is comparatively very low, 1832° Fahr.; and not only is its combustion perfect, but it generates free oxygen.



The value of this free oxygen lies in ensuring a perfect combustion of the other ingredients of the explosive mixture, which, in those preferably employed, are nitro compounds; that explosion leaves their components completely oxydized. This quality was shown to be absent in gunpowder, which has uncombined elements eager to seize on the oxygen of the air on being liberated by an explosion.

Another source of safety was contended for by the later French Commission on explosives in the appreciable length of time taken by mixtures of fire-damp and air to combine.\* Experiments went to show that it was actually possible to have a detonation generating flame that will not ignite fire-damp by having the temperature of detonation sufficiently low.

\*NOTE.—This conclusion seems hard to reconcile with the knowledge that an electric current of high tension will fire a gaseous mixture, and that the passage of such a current is made in an infinitesimal moment of time. This knowledge would advise caution before trusting to obtain an element of safety in the contention referred to, especially when it is also known that there is a sharp line in the scale of mixtures of gas and air, which varies somewhat with the composition of the fire-damp, but which is about 7% of gas, when a mixture from being quietly combustible merely, becomes instantly a violent explosive.

Marsh gas, the ordinary fire-damp,  $C H_4$ , detonates at a temperature of  $4,000^{\circ}$  Fahr., so that a mixture having, say a temperature of  $3,000^{\circ}$  Fahr., is a safe explosive. It will be noted in the following table that gunpowder generates a temperature very little in excess of that shown by an explosion of marsh gas :—

	FAHR.
Nitro-glycerine .....	5700°
Nitro-mannite.....	5700°
Dynamite.....	5290°
Guncotton .....	4745°
Gunpowder.....	4015°
Fire-damp.....	4000°

These temperatures are all in excess of the assumed limit of safety, and yet it is contended by the French Commission nitro compounds can with safety be employed by reducing the temperature of explosion of any one of them, a lower average being obtained by a mixture with ammonium nitrate. The effect of a mixture being somewhat as follows :—

	FAHR.
30 parts gelatinized nitro-glycerine with 70 parts of ammonium nitrate yielding a temperature of.....	3450°
20 parts gelatinized nitro-glycerine with 80 parts of ammonium nitrate yielding a temperature of.....	2910°
12 parts gelatinized nitro-glycerine with 88 parts of ammonium nitrate yielding a temperature of.....	2730°

The explosive force of these mixtures being, in comparison with dynamite at 100, as follows: 122, 118 and 111 respectively.

Nitro compounds have the further advantage that the intense heat generated by the explosion wave is very local, and the flame momentary, and not extended by the oxygen of the air.

Still, caution is necessary in generalizing, as the following records will demonstrate: A mixture of 30 parts guncotton and 70 parts am. nitrate, weighing some 1,540 grains, failed to ignite a gaseous mixture, but a charge of double the quantity with 20 parts only of guncotton and 80 parts am. nitrate, did ignite gas. Taking again the latter quantity with only 15 parts of guncotton and 85 am. nitrate, then the gas was not fired by an explosion of the mixture.



A similar experience was found when mixtures of dynamite and ammonium nitrate were experimented with: A cartridge weighing 770 grains, composed of 60 parts dynamite and 40 parts of nitrate, when exploded unconfined, failed to fire a gaseous mixture, while one of double the quantity with the percentage of dynamite reduced to 50, and even 40, did fire the gas. On the other hand a second doubling of the quantity to over 3,000 grains accompanied by a reduction of the dynamite to 30 parts, did not fire the gas.

These mixtures detonated completely with 8 grains of fulminate, but the decomposition was not complete when unconfined with less than 50 per cent. of dynamite. When confined a mixture of 20 parts of dynamite is completely decomposed.

The next step after treating with dynamite, which leaves a solid and incombustible residue, was to substitute a nitrated hydro-carbon which was combustible and had no solid residue. Nobel's improvement consisted of substituting gelatine, a soluble guncotton, in place of the infusorial earth, the absorbent in dynamite, and he so produced a solid material explosive throughout, and then by adding ten parts of military guncotton, which is not soluble, he produced blasting gelatine of still greater power. It detonates easily with  $11\frac{1}{2}$  grains of fulminate.

These compounds may be said to belong to the second great class of explosives for which confinement is not necessary to produce explosion, nor is combustion necessarily followed by explosion. When explosion does occur it is not by a rapid combustion as in powder passing from grain to grain, but an "explosive wave" is set up by a primary explosion, most conveniently, in practice, of some other material. The detonating substance generally employed is fulminate of mercury, so well known in the common percussion cap. Some explosives of this class require stronger detonation than others to produce the necessary dissociation of molecules, and the passage of an explosive wave through the mass varies seemingly with the intensity of the initial detonation. While a train of gunpowder, unconfined, burns at a visibly slow speed, the explosive wave set up by detonation in an unconfined train of guncotton has

been computed to travel at a speed of 18,000 to 24,000 feet per second, practically instantaneous. The rapidity with which the explosive wave is propagated in this class of explosives explains the reason for the local shattering action following detonation, and gives a valid excuse for the objection of the coal miner to the general substitution of one of such compounds for powder in coal getting.

The action seems to be in the so-called explosive wave striking, within measurable distance, compounds of this class, which may be either solid, or liquid, or gaseous, and producing dissociation of the component elements which in their nascent state reunite under the influence of the heat produced, and form chiefly the simple compounds water and carbonic acid, leaving the nitrogen uncombined. This is the result in laboratory experiments; but in practice the product of explosion are of doubtful composition, and probably vary with the environment, as for instance, where there is a space about the charge, or there is a partial combustion of the charge, or the momentary heat of the explosion causes the carbon of the fine coal dust about the charge to combine with excess of oxygen in the composition employed. In the latter case it is suspected danger may accrue from heated carbonic oxide coming through a fissure in the coal and uniting with another atom of oxygen from the air. This is only suspected as a possible complication under exceptional circumstances.

Reference has been made to carbonite, one of the earliest mixtures that was accepted. It is a mixture of nitro-glycerine, with an excess of carbonaceous matter, preferably wood-meal, which, in exploding, generates 15 per cent. of carbonic oxide.

Roburite is made of 14 parts of chloro-dinitro-benzol, with 86 parts of ammonium nitrate. Explosion under confinement breaks it up into water, carbonic acid, and free nitrogen; no carbonic oxide being generated.

Gelignite, a compound in use in England, has  $56\frac{1}{2}$  parts of nitro-glycerine,  $3\frac{1}{2}$  parts of nitro-cotton, 8 parts wood-meal, and 32 parts of nitre. It generates in explosion some 7 per cent. of carbonic oxide.

Ammonite contains 10 parts of nitro-naphthaline, and 90 parts of ammonium nitrate. Produces no deleterious fumes, and requires an extra strong detonator to explode it. Put up in metallic cases, cartridges are unaffected by wet. It is not frozen like dynamite. It has apparently many good qualities, but has only been tried experimentally, not being made in this country, and it is too costly to import.

Reputed relative strength of equal weights:—

Ammonite .....	100
Roburite .....	94
Dynamite.....	85
Acadine.....	66
Carbonite.....	54
Gunpowder .....	45

Or taking

Blasting gelatine with ammonium nitrate at.....	100
Dinitro-benzol with ammonium nitrate is.....	80
Dynamite with ammonium nitrate.....	75
Gun cotton with ammonium nitrate .....	72
Gunpowder .....	38

*Safety in handling.*—The makers of nearly all modern explosives claim their products can be handled with impunity, that packages of them may be let fall, that weights can be dropped on them from any height, and that they can be set on fire, and will burn without explosion following.

When dynamite was first introduced these advantages were also claimed for it, and there is no doubt dynamite has stood a great deal of ill usage without accident. The writer at that time, in the confidence of youth, held a cartridge of it in his hand and set it on fire; he has also seen a man enter a colliery store room and kick in, with his hob-nailed boot, the head of a 25 lb. keg of powder; but his curiosity for such experiments is satisfied; and now he prefers to see all explosives, regardless of their reputation, treated with respect. Dynamite, occasionally, has resented too great familiarity. In a paper read before the Society of Engineers, in 1889, it was stated, naturally enough, that the chief ingredient of flameless explosives, ammonium nitrate, was harmless, but it has since been shown that not only can it be detonated, though its detonation is uncertain, but that



it also can be exploded in small quantities by percussion. It may, therefore, be assumed that it is impossible to be quite sure of any explosive, or of what products temperature, moisture, mixing, and decomposition may produce in time, and however remote the limit of safety may by experiment seem, that it is somewhere to be found may be relied on.

*Fumes.*—Nitro-glycerine and dinitro-benzol are both poisonous; the fumes of both when burnt are injurious to breathe, but only to a limited extent, if at all, when perfectly exploded. Men become inured to both, and soon find that the fumes of roburite are no worse than those of gunpowder. At the same time, as a matter of practice, it would be well if miners allowed a minute or two to elapse before rushing in to see the effect of their shots, as is generally the custom with powder in coal pits. This practice may have been advisable where there was fear of the shot setting fire to feeders of gas, and it was desirable to beat out the flame before it got hold of the loose coal, but the same reason should not apply to the use of high explosives.

When first introduced men talked a good deal about the fumes, although advised no ill effects would follow, while although cautioned against handling the material, some are disposed to do so unnecessarily, and make cartridges of a size to suit individual ideas, and in this dangerous practice they should be checked.

With acadine, as with all nitro-glycerine compounds, the nitrous fumes in an ill ventilated place are apt to cause headache, but when habituated, men are known to speak of the fumes as less objectionable than the smoke of powder.

English experts on explosives make no mention of such a compound as acadine, no composition of ammonium nitrate with guncotton or nitro-glycerine being licensed in Great Britain, and the reason for this is given in the blue book of 1890, as follows: "All ammonium salts, especially when exposed alternately to moist and dry air at slightly elevated temperatures, lose traces of ammonia, and become acid. Nitro compounds like guncotton and nitro-glycerine are seriously affected by traces even of acids, and decomposition once started goes on and ultimately leads to

total decomposition, which may end in ignition and explosion." The report further explains that ammonia salts exert no dangerous action on such a nitro compound as denitro-benzol, and therefore, why the manufacture of roburite is sanctioned. It also states that the carbonate of ammonia may be mixed, presumably because any free acid when formed would at once combine with the ammonia and liberate the carbonic acid, and knowing this reaction a carbonate is probably added in the preparation of acadine.

It will also be noticed in the above excerpt, which is freely quoted by all makers of flameless explosives that do not contain nitro-glycerine, that the decomposition *may* end in explosion, and it is assumed the inspectors have reference more especially, if not entirely, to the storage of such compounds, a matter that is not under consideration with us.

*Practice.*—When experimenting was over and it was found that even blown out shots that were well tamped did not show flame, the new explosives were issued to the colliers, but immediately complaints followed of missed shots, of shots that did but half the work expected of them, and of charges that failed to explode on the detonation of the cap.

Roburite was first in the field in quantity, and the complaints applied to it. The trouble largely arose from men failing to comply with directions; they would tamp as they had been accustomed to tamp powder, that is from the stemming next the charge, although urged only to press home the first six inches of stemming, and told that if the cartridge was rammed hard, not only was there danger of the cap exploding, but that if the roburite was consolidated it would not explode, or would only partly explode, and they would lose the charge. With some men the latter often resulted, unless actually under supervision; and the irresistible desire to do so apparently arose from fear that part of the shot would be lost, that the coal would cut where the hard tamping began, and not at the back of the shot. Other men found a difficulty in understanding the difference between warmth and dryness. They would open cartridges unnecessarily long before they were to be used, lean them on the damp pave-

ment, and think they followed the instructions by covering the cartridges in this position over with a coat. Difficulty also resulted from cartridges arriving from the makers in a hard condition, and although men who got them were told to roll them or work them in the hand till soft, still some of these cartridges failed to completely explode, and discontent followed. Another source of trouble came from the holes not being properly rounded; cartridges would jam in a cornered hole, and when forced back were so consolidated that the roburite failed to explode. Now these complaints are seldom heard of; the grievances are cost and paying for the paper of the cartridges at roburite price, and having to use a detonator more powerful than that required in acadine.

To date, some 7,300 lbs. have been used, and reports of light resulting from explosions of the charges are few. In some four cases the stuff was set on fire by the detonation of the cap, and burnt without explosion in the hole behind the tamping. In what unusual form the stuff was in the cartridges that so acted has not been made out. Enquiry at the head office in England only brought back a denial of the truth of the statement, but a fact is a fact, however distasteful, and should be met with investigation, and not bold denial. The light or glow reported to have been seen in one or two cases, may have come from a "back" in the coal (or, doubtful, from a partial short circuiting of naked wires.) At first men used too much roburite, but with practice some have learned to proportion the consumption to the work to be done, and on an average it appears to be about two and a half times stronger than powder. Roburite has the advantage of not being affected by cold. Its strength has the disadvantage of producing a larger proportion of small coal than powder. It, of course, has the disadvantage, in common with acadine and all similar compounds containing ammonium nitrate, of absorbing moisture on exposure to the atmosphere, by which it is first weakened, and ultimately prevented from exploding. The cartridges, as usually made, are dipped in paraffin, and so made waterproof, but it has been found desirable to store these explosives in magazines where the air is dried by a steampipe;



at the same time it is probably judicious not to raise the temperature above 90° Fahr.

Acadine, with all compounds containing nitro-glycerine, is affected by temperature, and may not explode below 45° Fahr. It can be kept for many hours in a specially prepared can, holding hot water, and so be used in the coldest weather. Cartridges that harden otherwise than from cold have been found efficient, and hard tamping has not reduced the explosive power, but as it also requires a detonator to explode it, it is well not to tamp the first few inches of stemming next the charge. The fumes of nitrous acid that arise from its explosion have been already referred to. In strength it is about 50 per cent. stronger than ordinary powder, and some men find they can work the coal with it better than roburite. It is cheaper per pound, and requires a less expensive detonator. Should a charge fail to explode on the detonation of the cap, a primer with a fresh cap will explode the charge: not so with roburite, the detonation of the cap consolidates it and effectually prevents its subsequent explosion and the whole charge is lost to the miner. Free option is given the workmen to use which explosive they may prefer, and the quantity consumed to date is some 6,400 lbs.

In one case only has light been seen. A three foot bench, cut on the low side, had a 3' 6" hole charged with 12 oz. The shot cracked the back and along the high side, lifting the bench. The light was shown along the high side.

For the firing of shots no other means than electric fuses have been used, although several devices enabling fuse to be safely employed are known to have been adopted in France. Both magnets, electric and dry cell batteries, are in use; the latter, on account of their lightness, are preferred by the men, but they are comparatively short-lived, rarely firing over 1,000 shots each. The magneto-electric are heavy to carry about in the mine, and when made sufficiently powerful to fire several shots at once, may develop a tension too high for safety. On this point no definite knowledge has been obtained, but with the low tension batteries all experiments have failed to fire a gaseous mixture from the spark they give. For convenience, where

several shots are fired in a place each day, a pair of wires 100 feet in length are left in it, and where the coal is dry, common uncovered telephone iron wire is used, and no particular care seems necessary, with low tension batteries, to avoid contact, the dust and scale supplying sufficient insulation.

Complaints arise from imperfections in the detonators, causing miss shots at a cost to the miner of about a dollar each for loss of time and material; the percentage is high, nearly one half per cent., but this objection, it is hoped, will be remedied by a more careful selection of the fuses.

*Summary.*—Powder adds to the dangers of coal mining in pits that are dusty and gaseous. Being an incomplete explosive, it rarely does its work in a fall shot without showing light, if not flame; it ejects solid matter heated to a high temperature and heated gases capable of combining with the oxygen of the air and igniting fire-damp mixtures and dust, especially in blown out shots. The period of inflammation is of appreciable length.

On the other hand the so-called flameless explosives are complete in themselves; are instantaneous in explosion; generate a temperature below that produced by the detonation of fire-damp, and in explosion rarely show light or flame. When ordinarily tamped, blown out shots fail to show flame; it is, however, suspected that they may show momentary light when fired close to backs or lypes in the coal.

The mixtures recommended by the French Commission were:—

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| 1. | { | 20% dynamite (75 nitroglycerine, 25 silica) + 80 nitrate of ammonium.....   | Coal  |
|    |   | 40% dynamite, 60 nitrate.....   | Stone |
| 2. | { | Blasting gelatine (91.7 + 8.3 mononitric cotton) 12% + 88 nitrate ammonia.. | Coal  |
|    |   | “ “ “ “ 30% + 70 “ ..   | Stone |
| 3. | { | Octonitric cotton 9.5% + 91.5 nit. am.....                                  | Coal  |
|    |   | “ “ 20% ..  | Stone |
| 4. |   | Denitro-benzol 10% + 90 nit. am.....  | Stone |

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*CHANGES IN THE BANK AT THE INTERNATIONAL  
COLLIERY.*

BY J. S. M'LENNAN, B.A., M.E., SYDNEY, C.B.

The International Company has given much care to the preparation of its coal for market, particularly to ship it as free from impurities of all kinds as possible. Size is a quality of importance, particularly in local markets, but less so than freedom from slack and dirt. To this end Rigg's balanced screens were put in some years ago, and the arrangements were fully described and illustrated in a paper contributed by the writer to the Transactions of the Canadian Society of Civil Engineers. These were the best screens available for the length of bank we had, but it was found that a good deal of slack was carried over with the lump coal, the number of men required to pass the output over the screens was large, and the cost high.

It was determined to raise the bank  $8\frac{1}{2}$  feet, which would give us 11 feet additional length of screen bars, arranged above the movable screens, and this was carried out, as shown in the accompanying sketches, under the supervision of Mr. John Johnston, the manager at the mine. The coal is deposited from the tumbling cage on the upper part of the bars, where it is retained by a door until the screen is ready to receive it. This door is controlled by a lever brought close to one of the two men on the screens, and is balanced by a weight not shown in the sketch, so that it is easily opened and shut. It is opened enough to let the coal slide gently down to the lower end of the moving screen, and after it has come to rest it is examined by the men in charge, and when cleaned, if it is found to contain impurities, the screen is released under control of the brake, and the coal slides into railway car shown in cross section. Meantime a



second tub may be dropped into the screen above the door ready to be let down as soon as the moving section has returned by gravity to its place. We find that the coal is much better screened, as the slower rate at which it comes down allows it to spread out to the full width of the screen and the slack to fall through: but formerly, as discharged from the cage, its tendency was to come down in a mass, carrying with it a considerable quantity of slack, causing either much delay or an inferior grade of coal. To make run of mine coal the moving screen is covered with plates, and the slack box below the fixed part allowed to fill up level with the bars.

To avoid the expense and other disadvantages of raising all of the bank, the working arrangements were entirely altered. The plates which were previously used were taken up, and rails, as shown on the plan, were put down, and carriages to convey the empty tubs across the back of the pit were built. This shortening of the bank floor behind the pit still enables the engineer to have the bank floor in view. It was our intention to move these traversing carriages by balance weights, but it was found that it was so little trouble for the men to use them without assistance that they have not been put in. The substitution of a spring fastening, instead of corner chains on the cages, gave us sufficient height to make it unnecessary to raise the pulley frames as had at first seemed probable.

While the arrangement is not perfect in all its details, it is a great improvement on what we had before—two screens instead of three—and a reduction of nearly one-half in the number of men on the screens is a handsome advantage, and we have in addition the gain of making cleaner coal with less labor to all the men employed.

The capacity of the two screens has not been fully tested; they have, however, passed over 140 tons per hour without "scamping" the cleaning.

The writer presents this paper conscious to the full of its lack of importance: but its moral is that a careful exercise of thought in working out details, as was given in this matter by our Mr. Johnston, will often find an inexpensive solution of

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difficulties, the overcoming of which at the first blush would seem to require a heavy outlay—a moral which, if well founded, is in these days of narrow margins comforting to those who have to do with mining in Nova Scotia, and more especially to those in charge of plants erected for a much smaller output than they now have to deal with.

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MR. McLENNAN—We have done over 1,400 tons run of mine coal in ten hours. The staff of men being reduced from fifteen to eight.

*RECENT GOLD MILLING PRACTICE IN NOVA SCOTIA.*

BY JOHN E. HARDMAN, S.B., M.E., OLDHAM, N.S.

In the practice of every art it is always desirable to have a body of reliable data accessible, to which to refer for comparisons, and by which to check one's own methods and results.

So far, in gold milling, the data on record refer almost entirely to large mills, *i.e.*, those having forty or more stamps; and to the (comparatively) softer ores of the United States and Australia. I have thought, therefore, that it might be acceptable to record some data for Nova Scotia, and for small mills of ten or twenty stamps. The time, perhaps, is opportune for the reason that within the last three years there has been a decided step forward in the business of gold milling in the province. Three years ago I had the honor to read a paper on the Empress mill at Renfrew,\* which had then recently been built by Mr. D. S. Turnbull for the Empress Gold Mining Co., and which may be regarded as the pioneer mill of the new practice in Nova Scotia. This mill, in its design, construction, and detail, was a reproduction of the type adopted by the Homestake Mining Co. in their large mills at Lead City, South Dakota, and in its operation it fully sustained the reputation of the type for fast crushing, with close saving of the free gold. Like its prototype at the time, it had no concentrating plant to save the sulphurets, which were reported worth \$20 or less to the ton. No figures of costs or results from this mill are available for publication.

Since the construction of the Empress mill in 1889, eight other mills, aggregating 150 head of stamps, have been built in the province in which the Homestake type of mortar (modified in three mills as to minor details), has been adopted.

In these mills, the design and construction of the buildings, ore bins and accessories have been subject to local conditions, and hence have been of diverse character.

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\* *Canadian Mining Review*, vol. viii., p. 73.

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It is not my purpose to give descriptions of all these different mills, but rather to induce members in charge of the same to put on record their experiments and experience.

As to two of these mills, however, (those of the Oldham Gold Co., and the West Waverley Gold Co., Ltd.), which have been designed and constructed under my supervision, I am enabled to give you descriptions, and figures as to costs, capacity and saving effected. The two mills have been built on practically the same lines, and the plates of the Oldham mill given herewith show essentially the characteristic features of the Waverley mill. The Waverley mill is driven by steam power, the Oldham mill by water power. As the Waverley mill has been dropping its stamps for about two months only, the figures relating to it are given subject to correction, but the figures relating to the Oldham mill represent twelve months' continuous work. In designing the structure, care was given to make each component of the mill independent, *i.e.*, the building, the battery frames, and the ore bins are each entirely separated from the others, so that the building is simply a cover with no strains upon it other than those due to wind and weather; the battery frames are not connected either with the building or the ore bins, and hence no vibrations are communicated to them or from them to other parts of the structure; also the ore bins, upon the top of which is placed the rock breaker, are free and disconnected. The mill contains but ten stamps, and its character and design will be readily understood from the accompanying plan and sectional elevations. I may say here that no originality is claimed for either of these mills. In their design and construction the whole object was to select the best features from practice in other places, and such as had been proved and tested, and to combine them into such an aggregate as should be efficient, economical, and best adapted to the work required.

As to the machinery details, the first one to which I will draw your attention is the use of the "Forster" rock breaker, in the place of the old "Blake" and the newer "Gates." The machine in the Oldham mill is a number three, the size of the receiving opening being 7 inches by 18 inches, which easily takes in a slab of rock 6 inches by 17 inches. The Waverley mill has one of the largest size, jaw opening being 12 inches by 21 inches, and capacity being 125 tons in ten hours. The preference was given to the Forster in both of these mills for the following reasons: (1) for machines of equal capacity the Forster requires very much less power than either of the others, taking less than one-half

the power required by a Gates; (2) the total weight of the Forster machine, of equal capacity, is only about one-half that of the Gates and considerably less than that of the Blake; (3) the vibratory motion induced by the machine is very much less than that produced by the Blake, and no more, if as much, as that produced by the Gates; (4) the cost of the Forster is less than either of the two others.

In small mills, to which I wish it clearly understood my remarks are meant to apply, the points referring to the amount of power required and the first cost of the machine, are important factors, and where the breaker is mounted on the top of the ore bins, total deadweight and the vibration are almost equally important. For larger mills I am inclined to consider that the Gates might be preferable, but I can see no situation where I believe a Blake would be the equal of the Forster.

The small breaker in the Oldham mill is driven 300 revolutions per minute by a 5 inch belt, and at that speed crushes 5 tons an hour to pass an inch and a half ring.

From the rock breaker the ore drops into the ore bins, which present no points of novelty and which will be easily understood from the sectional view. Chutes lead from these bins to the hopper of the "Hammond" automatic feeder. The feeder is the one which has been in use at the Alaska-Treadwell mill on Douglas Island for some years. It has given us every satisfaction. It is positive with wet and dry ores, is superior in its freedom from attendance, can be regulated with great exactness, and is much cheaper both in first cost and repairs, than either the "Tulloch" or the "Challenge." Its construction will be readily understood from the drawing. A small auxiliary split tappet fastened on one of the stems between the guides, serves to operate the lever.

The style of battery frame is new to Nova Scotia, being adopted from the Grass Valley practice, where it is known as the "knee frame." Its essential point is the removal of the line shaft from its usual position behind the mortar and beneath the feeder floor, to the front of the batteries and on a level with the cam shaft.

The merits of the arrangement are many: (1) the shaft is always in sight, it has the best light in the mill, and is easy to align when necessary; (2) it is removed from beneath the feeder floor, where it is in darkness, and subject to the dampness, drip and fine dirt which will inevitably work down upon it and its bearings; (3) any repairs to the shaft when below the feeder floor have to be made by artificial light, and in

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confined spaces which are usually abounding in grit and fine dirt ; (4) it enables the cam shaft belt to be run horizontally, or nearly so, without a tightener, and thereby saves a great deal of wear on the belt. As against these advantages, one possible point of disadvantage is made, viz : that the main shaft is more liable to get out of alignment when erected on this knee frame than when placed on the solid cross sills behind the mortar blocks. To this it may be answered that if the knee frame is properly made and braced, of heavy timbers, the chances of malalignment are very slight and are easily remedied.

On this line shaft a Hunter friction clutch pulley serves to disconnect the cam shaft without disturbing the running of the rest of the mill.

The mortar blocks are built of selected two-inch spruce plank, twelve inches and six inches wide, planed on both sides and jointed on both edges. The blocks are built thirty inches wide, and are therefore made up of two twelve inch planks and one six inch in each layer ; joints in one layer are broken in the next, and each layer is spiked to the previous one with 40dy. nails (five inches long), so that each nail holds in three layers. Each plank is fitted on the bottom to the surface of the solid bedrock, as it was found impracticable to dress off the whin rock to a smooth and level surface, and concrete is valueless unless put down in large masses.

The two blocks for ten stamps are built together, so that the Oldham foundation is one solid piece of timber thirty inches wide, fourteen feet deep, and twelve feet two inches long. In the Waverley mill the blocks were built in the same manner, but are for twenty stamps. As bedrock was four feet deeper, and a clear space of four feet was left between the two cam shafts, the final block in Waverley measured thirty inches by eighteen feet by twenty-eight feet four inches.

The holding down bolts were put in as usual, with the exception that the standard threads for one and one half inch bolts were not used ; instead of six threads to the inch, twelve threads to the inch were used, with standard size hexagonal nuts. This substitution of a finer thread not only gives greater strength,\* but also serves to prevent the jarring loose of the nut by the vibration of the mortar.

The mortars are modified from the Homestake pattern only in the fronts, which are cut down to within two inches of the bottom, the height of the front being regulated by wooden chuck blocks faced with thin steel plate. Also the lip has been extended three and a half inches.

\* See paper of Major W. R. King. Trans. A. I. M. E., vol. xiv., p. 90 *et seq.*



The accompanying detail drawings will show the character and extent of these changes.

The essential character of the mortar is not at all affected by these modifications which have been made only for minor points of convenience. The cutting down of the front was done for two reasons: first, because the Oldham mill is also a custom mill and it was desirable that the whole inside of the mortar should be readily accessible for a thorough clean up; and secondly, because of the very diverse character of the quartz coming to a custom mill, necessitating perhaps a high discharge for one lot and a very low discharge for another lot. It has been found also, in the experience of twelve months, that the slight spring, or give, which the wooden chuck block has (although *very slight*) is sufficient to cause the amalgam to settle a little lower round the dies than it does in the solid front type. The extension of the lip was made in order that the apron plates might be entirely free from the mortars, and receive no motion or vibration therefrom.

The cams, tappets, bosses, shoes and dies are of the usual Homestake pattern, the full stamp with new shoe, weighing 858 lbs. Sectional guides such as were described in the paper on the Empress mill, have been used, with the addition of a long diagonal washer to prevent checking or warping. The guides are 14 inches long, made of sound yellow birch wood. They have been in use in the Oldham mill for twelve months, and are good for several months yet before being trimmed down. The lubricant used is a mixture of tallow and graphite, applied warm. The front elevation of battery frame shows the sectional guides in position, but does not show the diagonal washer.

The plates for catching the amalgam are four in number.

The first plate lies inside the mortar, just at the lower edge of the screen, and about ten inches above the foot of the dies. It is made from a strip of copper one-eighth of an inch thick and one and three quarter inches wide; the length being the full length of the screen, about forty-eight inches. This copper strip is placed on a bar of square iron, and from one quarter to three-eighths of an inch in width is bent over at right angles for the whole of its length. It is then fastened to the rounded or bevelled edge of the wooden chuck-block by screws, the longer side sloping upwards towards the screen at an angle of about 45 degrees with the horizon, while the shorter side inclines towards the stamps at an equal angle, forming a narrow V-shaped trough, as shown in fig. 1 sectional view of the mortar.

This plate has proved most effectual, as will be shown further on, and the wear upon it, after twelve months, is not noticeable. It does not choke nor fill with sands, the splash from the screen being sufficient to dislodge the sands but not the amalgam. Outside the mortar there is a splash plate eight inches wide, set at a run of three-quarters of an inch to the foot, which catches 80 per cent. of all the gold caught outside of the mortar. This plate discharges the pulp upon what is called the "quadrant plate," which is a sheet of copper running the full width of the apron plate, but curved round the quarter circumference of a circle whose radius is 9 inches in the Oldham mill and 6 inches in the Waverley mill. The prime function of this plate is to spread the pulp perfectly smooth and even upon the long apron plate below, but it has also been found to be a most efficient amalgam and mercury saver. From this quadrant plate the pulp has a drop of one inch upon the upper end of the apron plates, which are fifty-four inches wide by ten feet long and have a pitch in the Oldham mill of one and three-quarter inches to the foot. From the apron plate the pulp drops into a box on the end of the wooden table, whence it is led by an iron pipe two inches in diameter to a mercury box of the Grass Valley type, thence through a short wooden sluice to a box of the same pattern as is used in the Black Hills, thence, in the Oldham mill, to a Golden Gate concentrator, which handles all the sands from ten stamps with ease, being from 24 to 30 tons in 24 hours.

The tables upon which the apron plates are laid are arranged so that the pitch can be varied from one and three-eighth inches to the foot as a minimum to two inches to the foot as a maximum. Reference to the sectional elevation of the mill will show that the tables (F) rest upon two stringers (A) of 3" x 5" scantling and are kept from sliding downwards by a block or cleat (G) nailed to the stringer. These stringers lie loose in notches or gains cut in the standards (B), and a hard wood pin (C) keeps each stringer from sliding downwards, but admits of sufficient freedom to raise the lower end as required. The standards are nailed to the floor and have no connection with the mortar blocks, nor has the floor, a coarse saw-cut separating the boards of the floor from the blocks. At the lower standard a hardwood wedge (D) is inserted, which has a slot cut in the middle, through which a bolt (E) and thumb nut is run. By means of this wedge the inclination can be changed to suit the character of the pulp passing over the plate, the wedge being locked in position by the thumb nut. The upper edge of the copper

apron plate is turned up one inch, behind the lip of the mortar, but not touching the mortar, so that there is no point of contact between the outside plates and the mortars.

The floor of the battery room is laid in hard pine with a pitch of half an inch to the foot, and a sluice is arranged to carry all washings from this floor to a mercury trap below. The floor is washed down by a hose every shift.

The lowest floor of the mill measures 38 feet by 30 feet. Upon it, besides the Golden Gate concentrator, are the boiler for heating the mill in winter, the coal bin, the retorting and smelting furnace, and the casing or housing of the Pelton wheel which furnishes the power for the mill. The shaft of this wheel is on a level with the floor, the wheel-pit and tail-race being excavated below it. From this shaft a sixteen inch, six ply rubber belt conveys the power to the line shaft, whence it is distributed to the cam shaft, the rock breaker, the exhaust fan and concentrator.

The Pelton wheel referred to is a six foot standard single nozzle wheel, operated by water under a head of seventy-six feet eight inches, or a pressure of about 33 lbs. per square inch. This water is brought in by a ditch 1,026 feet in length, to the forebay, whence 540 feet of pipe, made of No. 14 gauge iron and sixteen inches in diameter, conveys the water to the interior of the mill. Inside the building the diameter of the pipe is gradually reduced to eight inches, where it is joined to the wheel gate by flanges. This pipe line is provided with three valves, located in appropriate places, one for blowing out air when filling the pipe, one for automatically admitting air in the event of a vacuum being formed in the pipe, and the third valve is an Ashton pop safety to relieve any abnormal pressure arising from suddenly shutting the water off the wheel. Four nozzles of different diameters ( $2\frac{3}{4}$ ", 3",  $3\frac{1}{8}$ " and 4") are supplied, to be used as the demands of power vary; the three inch nozzle is the one usually used at Oldham. With this size of nozzle, venting about 250 cubic feet of water per minute, the wheel develops more than 25 horse power, which is sufficient to run the entire milling plant.

I am informed by the Pelton Water Wheel Co. that this is the first wheel of the kind sent to Canada, outside of British Columbia. It has been continuously in use since it was installed, and has given every satisfaction, both in cold weather and in summer.

As Nova Scotia abounds in water powers, in which in many cases the flow of water per minute is too small to be utilized to advantage in a tur-

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bine, it may not be out of place to say that this wheel will render many of these powers valuable wherever the conditions are such as to permit of obtaining readily a head of 40 feet or more at reasonable distances.

The motive power of the Waverley mill is a tandem compound condensing engine, cylinders 8" and 12" by 12", with a Meyer's adjustable cut-off. Boiler pressure is carried at 100 lbs., and steam is cut off at  $\frac{1}{4}$  when condensing, and at  $\frac{1}{3}$  when run compound but not condensing. The economy of this type of engine is too well known to need further demonstration. In the Oldham mill the pulp, after leaving the last mercury trap, flows into the hopper of a Golden Gate concentrator, whence the tails run into the brook, the headings being saved in a box. The average mineral contents of the quartz crushed is about 2 per cent., the sulphurets saved are very clean, averaging over 90 per cent. mineral, and assay \$70 per ton in round numbers.

No concentrator has yet been added to the Waverley mill, the merits of several machines being under consideration. The percentage of sulphurets will run about the same, from 2 per cent. to 3 per cent.

This brief description of the equipment and character of the mills under consideration will serve to bring out the main points wherein the recent practice differs from the older practice. The adoption of the narrow mortar with inclined screen, the rapid, but short, drop of the stamps and the narrow V-shaped inside plate, are features which have been developed by reason of the necessity for getting increased capacity without impairing the efficiency of the battery as an amalgam saver.

I am enabled to give some of the actual working results of these mills, and hope to supplement them in a future paper.

As to increased capacity: The Oldham mill drops its stamps 85 drops per minute, six and a-half inches, and the screen used is an indented Russia iron slot, having a No. 7 needle, the equivalent of 30 meshes to the inch. Under these conditions the capacity of the mill is from 28 to 30 tons per 24 hours, or  $1\frac{1}{6}$  to  $1\frac{1}{4}$  tons per hour; or  $2\frac{8}{10}$  to 3 tons per stamp per diem.

I may say here that the Oldham mill has to be used as a custom mill, being the only operating mill in the district. Hence the variety in the character of the quartz in the lots presented for crushing causes a considerable variation in the capacity under the conditions given. From clean, hard, compact quartz, the mill often goes upon soft, much weathered and decomposed slate belts, carrying very little hard quartz.

But with the speed, drop and screen given, the capacity of the ten stamps is a minimum of 1 ton per hour, and a maximum of 1 1/4 tons per hour.

As to the efficiency of the amalgamation, I have summarized the results of the last twelve months' work from records which have been kept of each and every lot or parcel crushed. As stated before, the lots come from three different companies as well as from tribute workers, and the gold contents varied during the year from \$1.50 per ton to \$800 per ton of stuff crushed, the average being about \$18. The size of the lots also varied from 5 tons to over 200 tons.

Of each separate lot a record is kept, showing among other things :

- (1) The weight of material crushed.
- (2) The time occupied in actual milling.
- (3) The weight of amalgam obtained from the outside plates (*i.e.*, splash, quadrant and long apron plates).
- (4) The weight of amalgam in inside V plate.
- (5) The weight of amalgam in mortar sands.
- (6) The weight of retorted gold.

There is, therefore, a body of data upon which to base satisfactorily a general average, and also an opinion as to the efficiency of the mortar.

Calculated into percentages the results are :—

	Per cent.
Percentage of gold on outside plates.....	8.55
“ “ inside plates .....	23.40
“ “ in mortar sands .....	68.05
Total gold. ....	100.00

It will be seen that the percentage of gold retained in the mortar behind the screen is 91.45 or 91 1/2 in even numbers.

The *highest* percentage ever obtained on outside plates was 15 4/10, leaving 84 1/10 per cent. as the lowest percentage of gold saved in mortar.

The *lowest* percentage ever obtained on outside plates was 2 1/10, or 97 1/10 per cent. saved in mortar.

These figures are, to my mind, the most satisfactory answer to the statement which has been made, that this style of mortar would not save the gold inside the screen, but would grind it. In only one case have I seen the gold show signs of having been ground, and that was in one small lot which was crushed while the cam shaft belt was slipping, and the speed was consequently reduced to 70-75 drops per minute.

The mill-man seeing these figures will next ask : “What is the value of your tailings ?” The average assay value of the tailings as they go

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upon the concentrator is \$2 per ton, but this value is almost entirely in the sulphurets, the tailings from the concentrator varying from 20 cents to 50 cents per ton. Samples of tailings from which the sulphurets were eliminated by careful panning showed only traces of gold.

The mill-man from Australia or South Africa will be inclined to doubt these figures until he is told that the gold in Nova Scotia quartz is coarse (comparatively speaking). It is very doubtful if there is any quartz vein worked in Nova Scotia which carries gold of such a degree of fineness as to be invisible to the eye, or so fine as not to be saved by stamp-mill work if the mill is a proper one and the amalgamation skillfully performed. I am fully aware that this statement will provoke discussion, but I make it after nearly eight years' diversified experience in this country, and after two years' very careful study of the question. In some veins the sulphurets carry fine gold mechanically combined, of which a certain proportion is set free by fine grinding in a pan, but all such sulphurets with their contained gold are much more satisfactorily handled by concentration than by fine grinding with the consequent sliming.

The essential and important factor of this large percentage of gold saved in the mortar is the rapid short drop of the stamp. With the narrow mortar of western pattern, slow speed is the enemy of successful saving of gold behind the screen. The relative height of the screen above the die, and the coarseness of the mesh, are important factors it is true, but they are entirely secondary to the speed. I have dilated somewhat upon this point because some of the mills having mortars of this type in Nova Scotia have been blamed for not saving gold, and upon them has been laid the blame of unsuccessful ventures.

Whatever the true cause of these failures may be, it certainly cannot be the form of the mill mortar, if this same form does the good work it has done for years in the Western United States, and has done lately in the mills under consideration in this paper.

The results, as to capacity and efficiency, in the Waverley mill, although covering only a limited period (some 800 tons crushed) fully bear out the figures given above. The speed in the Waverley mill is 100, the height of drop six inches and the screen 30 mesh. The duty is 30 tons per diem. The average saving behind the screen has been 90 $\frac{1}{2}$  per cent., on the plates 91 $\frac{1}{2}$ .

Coming finally to the costs of milling, we naturally cannot expect small mills to work as cheaply per ton of material handled as the large



ones do, but yet in Nova Scotia, where both fuel and labor are cheaper than in the west, we may expect to approximate the costs of the best mills elsewhere.

In Prof. Hofman's paper on "Gold Milling in the Black Hills," the cost at two different establishments is given as: \$0.8349 per ton, and \$0.87 per ton. If we deduct from these figures the item for fuel, a very expensive item there, the costs stand about .56c. per ton milled. Taking the costs at some of the best of the California mills,\* the results in 1888 were:—

Plymouth mill, 160 stamps, water power.....	\$0.3900
Bunker Hill mill, 40 stamps, water power.....	0.6000
Plumas Eureka mill, 60 stamps, water power.....	0.4875
Sierra Buttes mill, 80 stamps, water power .....	0.3450

The costs at the Oldham mill are given in detail as follows:—

	Per ton.
Labor .....	\$0.2730
Supplies .....	0.0293
Iron. ....	0.0264
Quicksilver.....	0.0205
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	\$0.3492

This figure, it must be borne in mind, is for a mill doing custom work, which necessitates much loss of time and consequent loss of tonnage, and higher costs per ton. The same mill, when running on large lots, has reduced the cost per ton for labor \$0.063, making the total cost per ton for large lots \$0.2862. During the winter months an extra charge of \$0.0351 is made to cover the cost of fuel required to warm the mill. The highest cost per ton, therefore, in the Oldham mill during the past year has been 38 $\frac{4}{10}$  cents, and the lowest 28 $\frac{6}{10}$  cents.

Figures of costs for the steam mill at Waverley are not yet available, for the reason of the short time the mill has been at work, but the cost sheets for May showed the figure of 48 $\frac{1}{10}$  cents. I have reason to believe that this figure is not far astray, and that the result of the first year's work will show a cost figure not to exceed 50 cents per ton.

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\* California State Mining Bureau. Eighth Annual Report of State Mineralogist.

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ones do, but yet in Nova Scotia, where both fuel and labor are cheaper than in the west, we may expect to approximate the costs of the best mills elsewhere.

In Prof. Hofman's paper on "Gold Milling in the Black Hills," the cost at two different establishments is given as: \$2.80 per ton.



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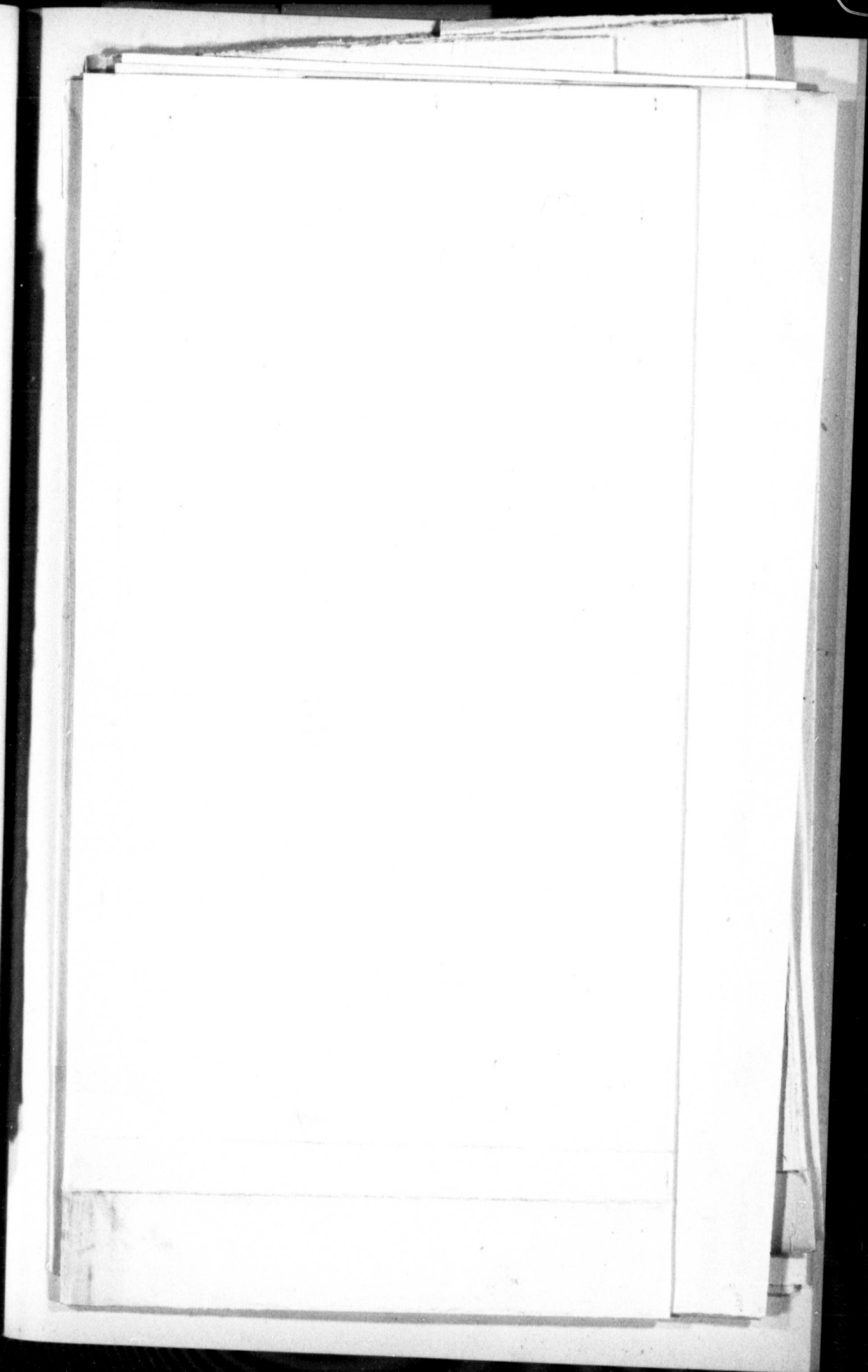


PLATE I.—To Illustrate Mr. McLennan's Paper on "Changes at the Bank of the International Colliery."

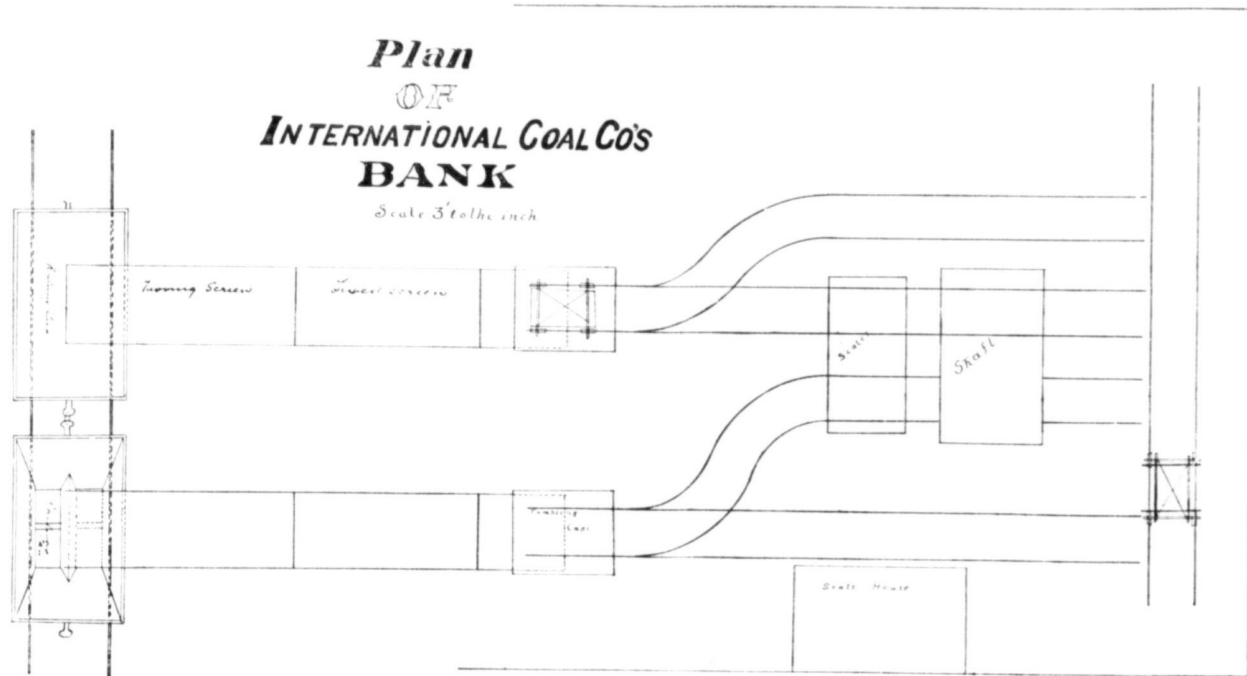


PLATE II.

**Sectional View**  
**OF**  
**INTERNATIONAL COAL CO'S**  
**BANK.**  
Scale 3' to the inch

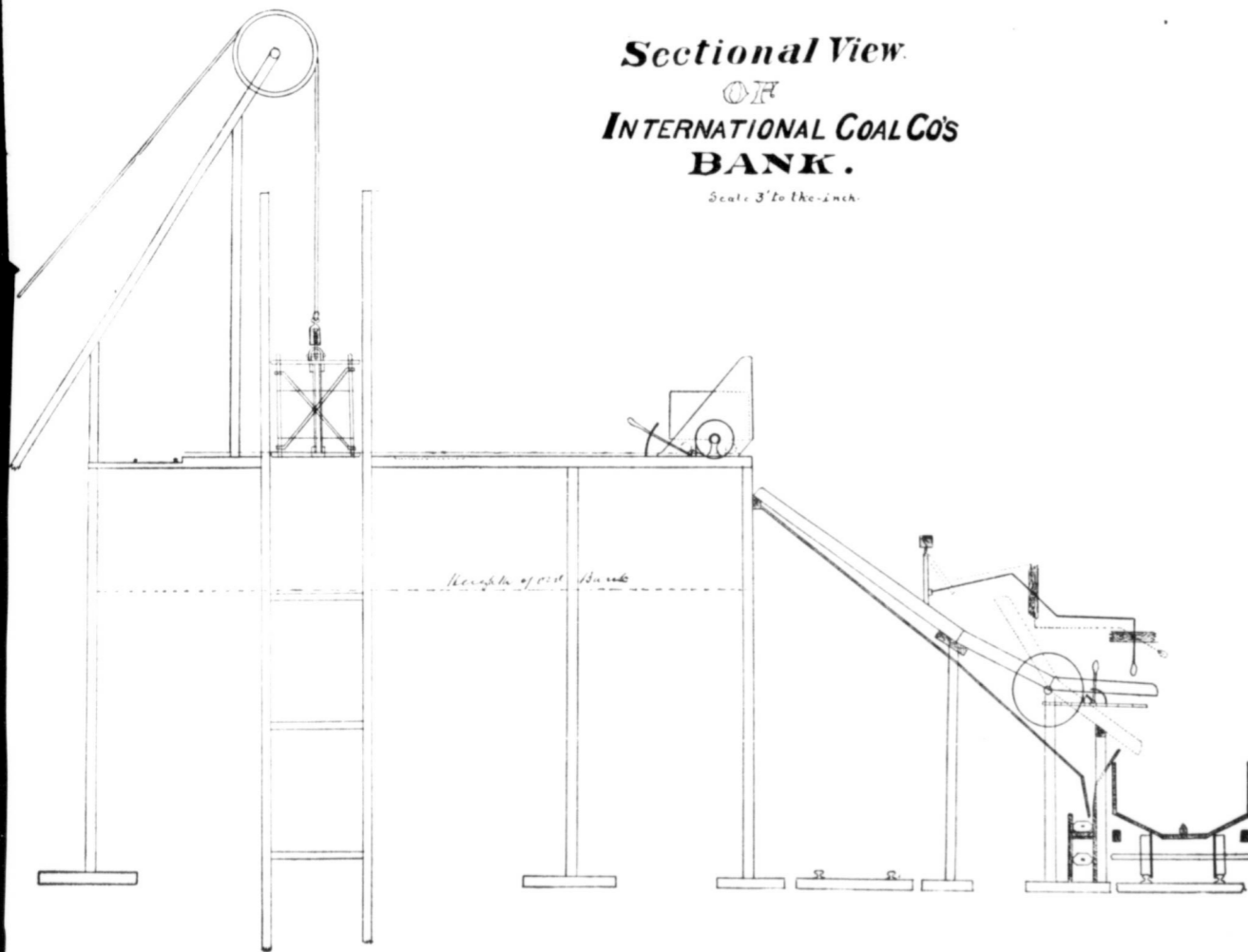


PLATE III.—To Illustrate Mr. Hardman's Paper on "Recent Gold Milling Practice in Nova Scotia."

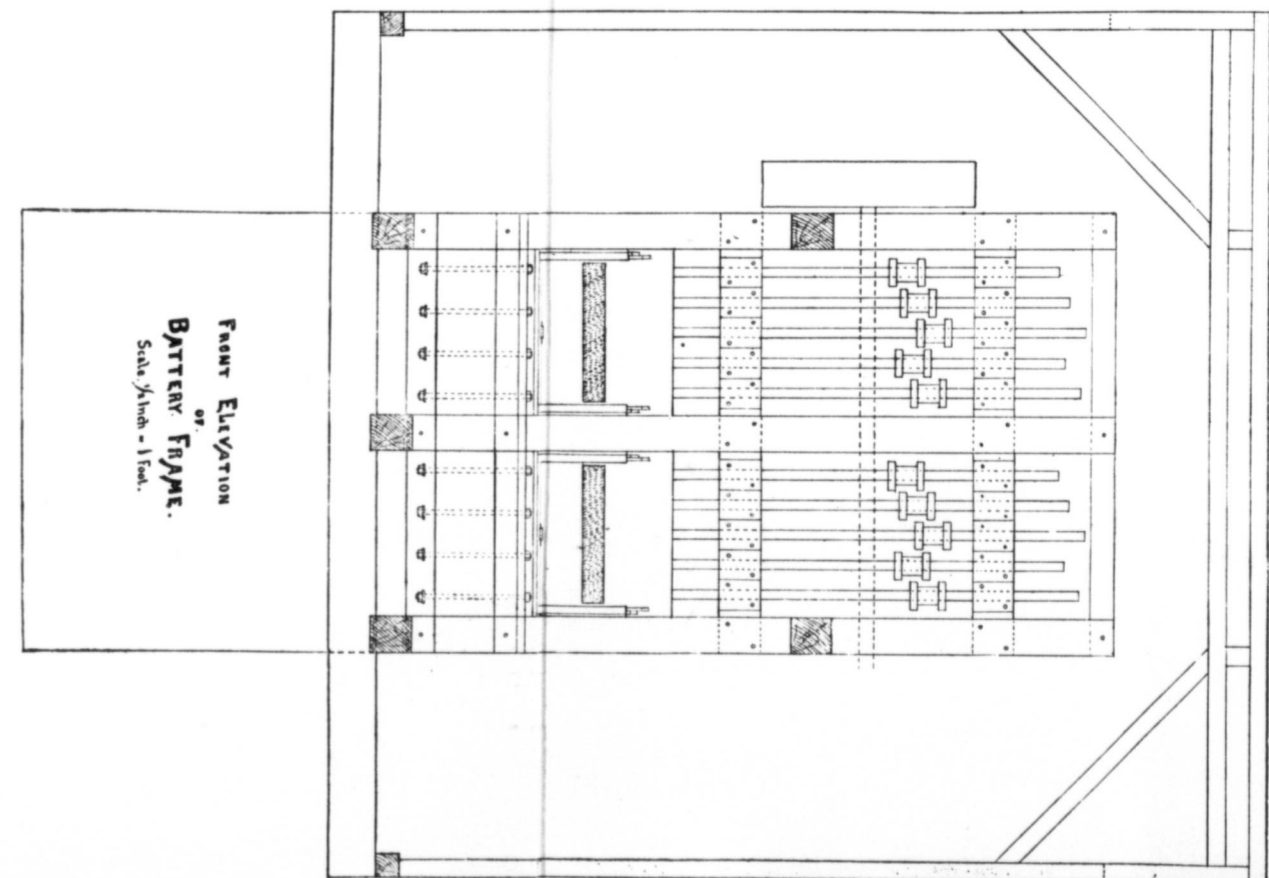
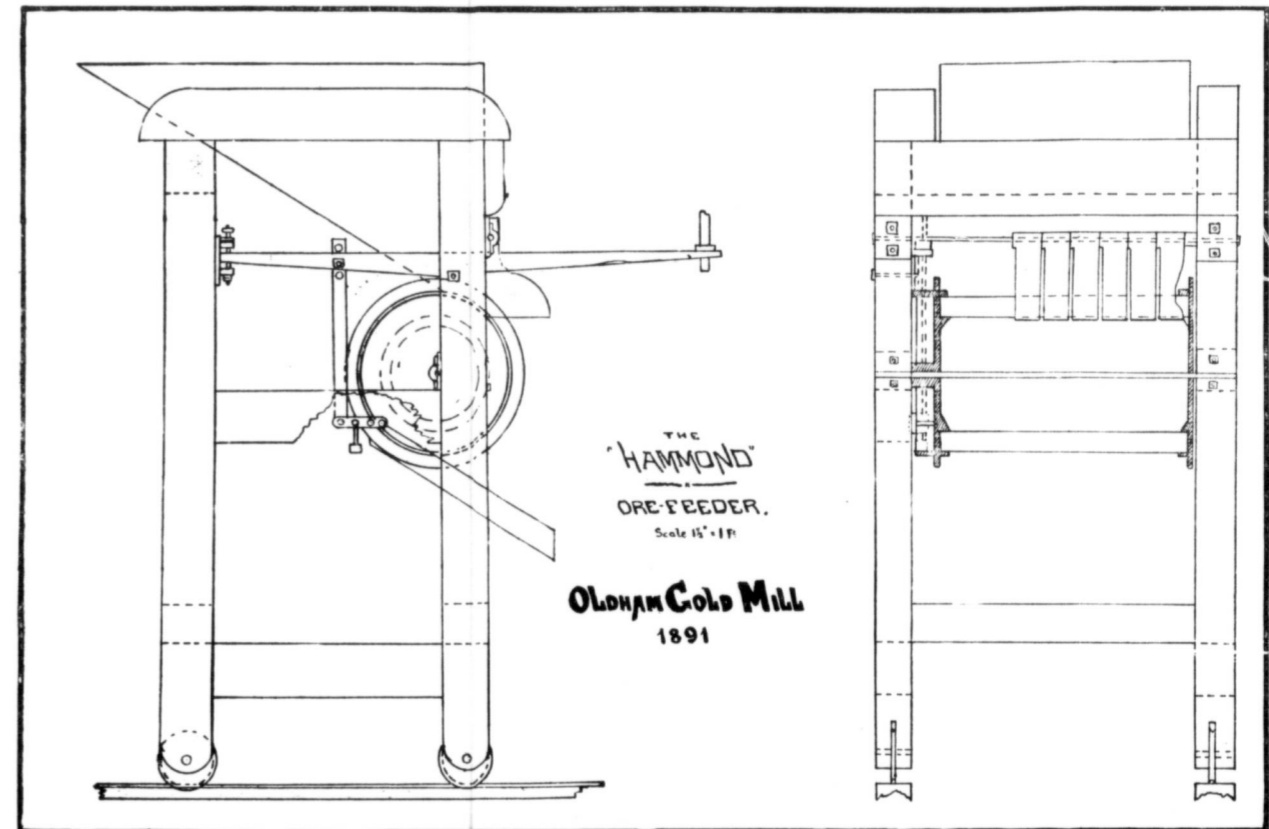
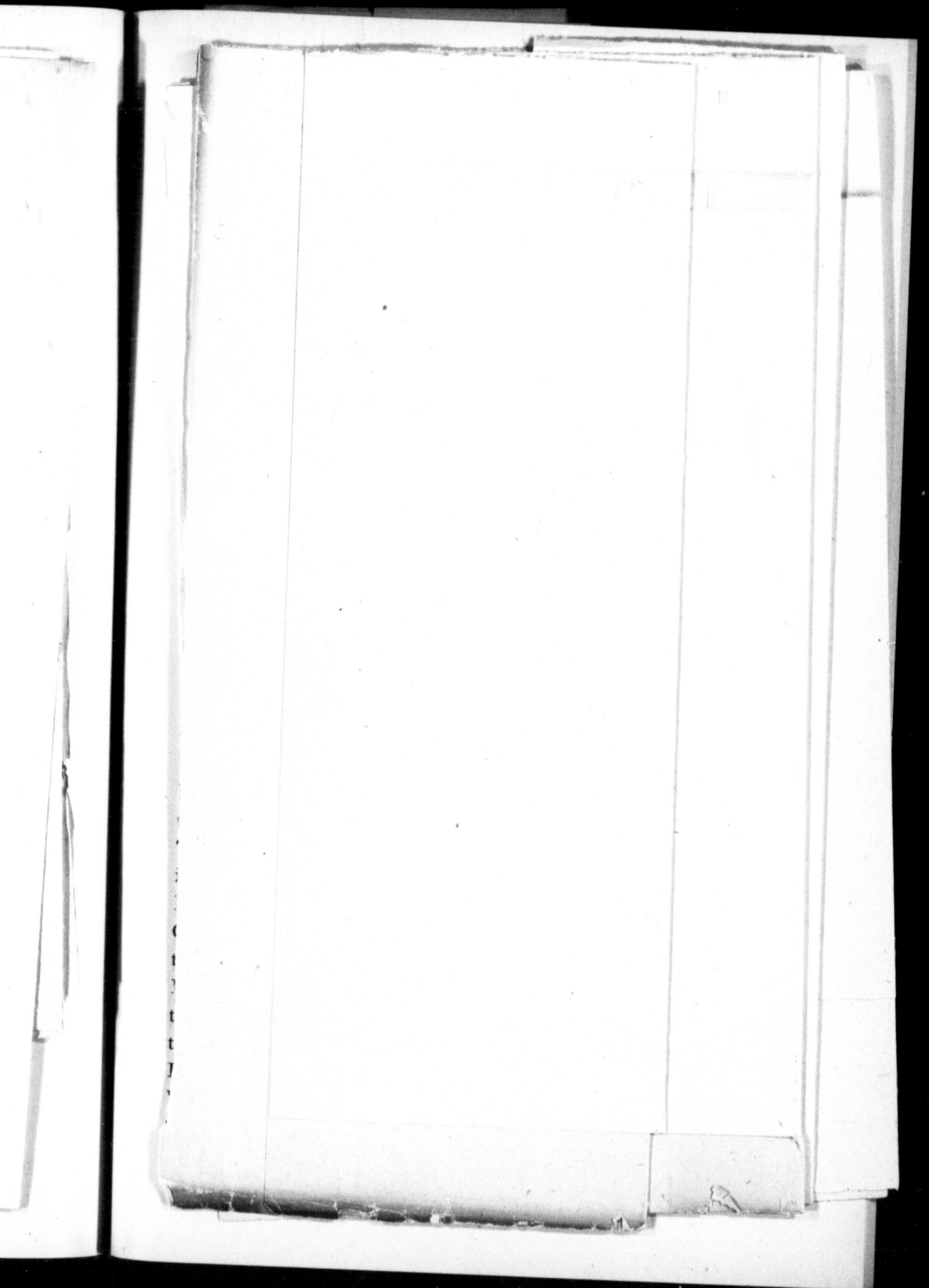


PLATE IV.—To Illustrate Mr. Hardman's Paper on "Recent Gold Milling Practice in Nova Scotia."



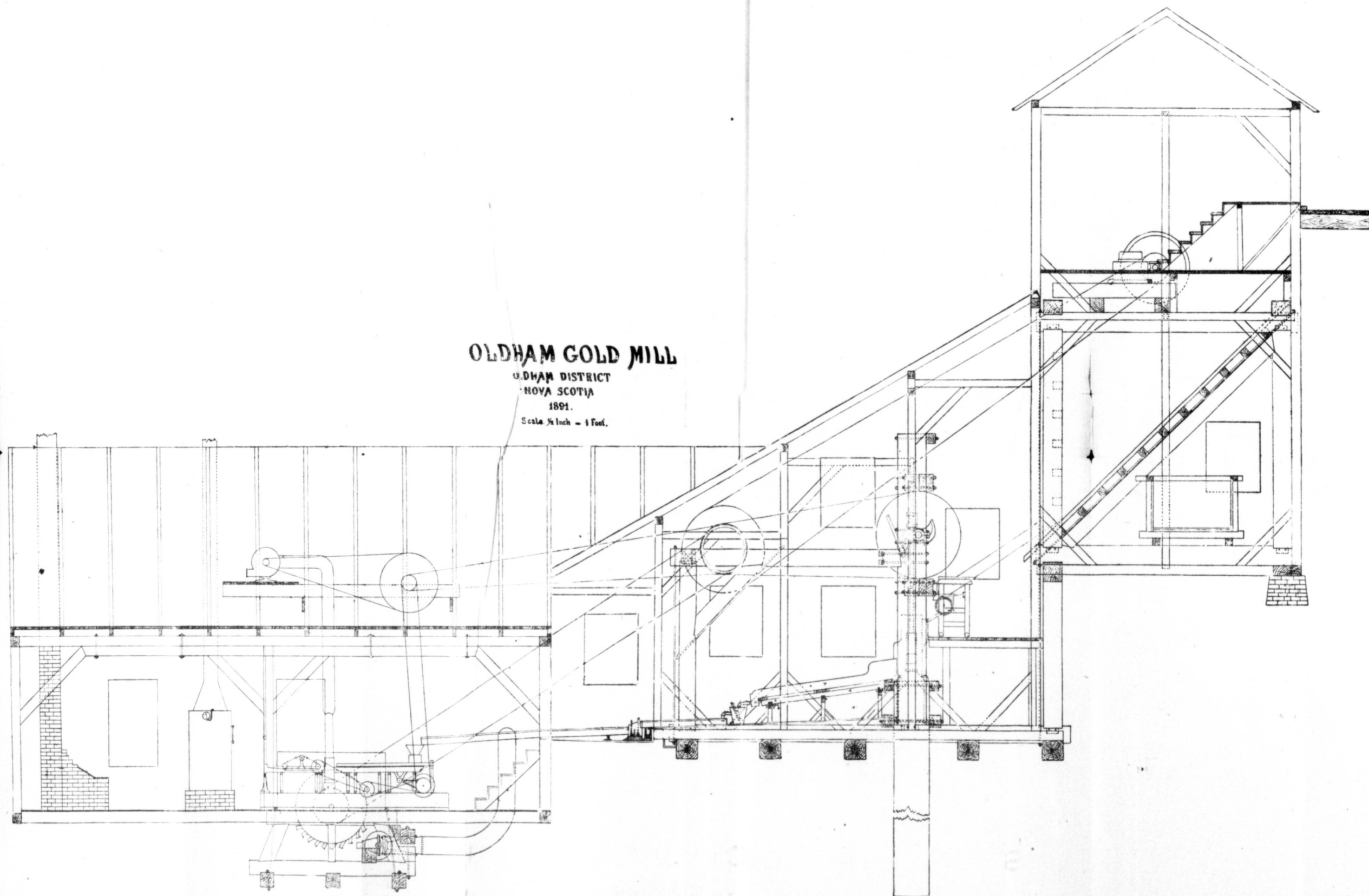




# TRANSACTIONS OF THE MINING SOCIETY OF NOVA SCOTIA

To Illustrate Mr. John E. Hardman's Paper,

"RECENT GOLD MILLING PRACTICE IN NOVA SCOTIA."

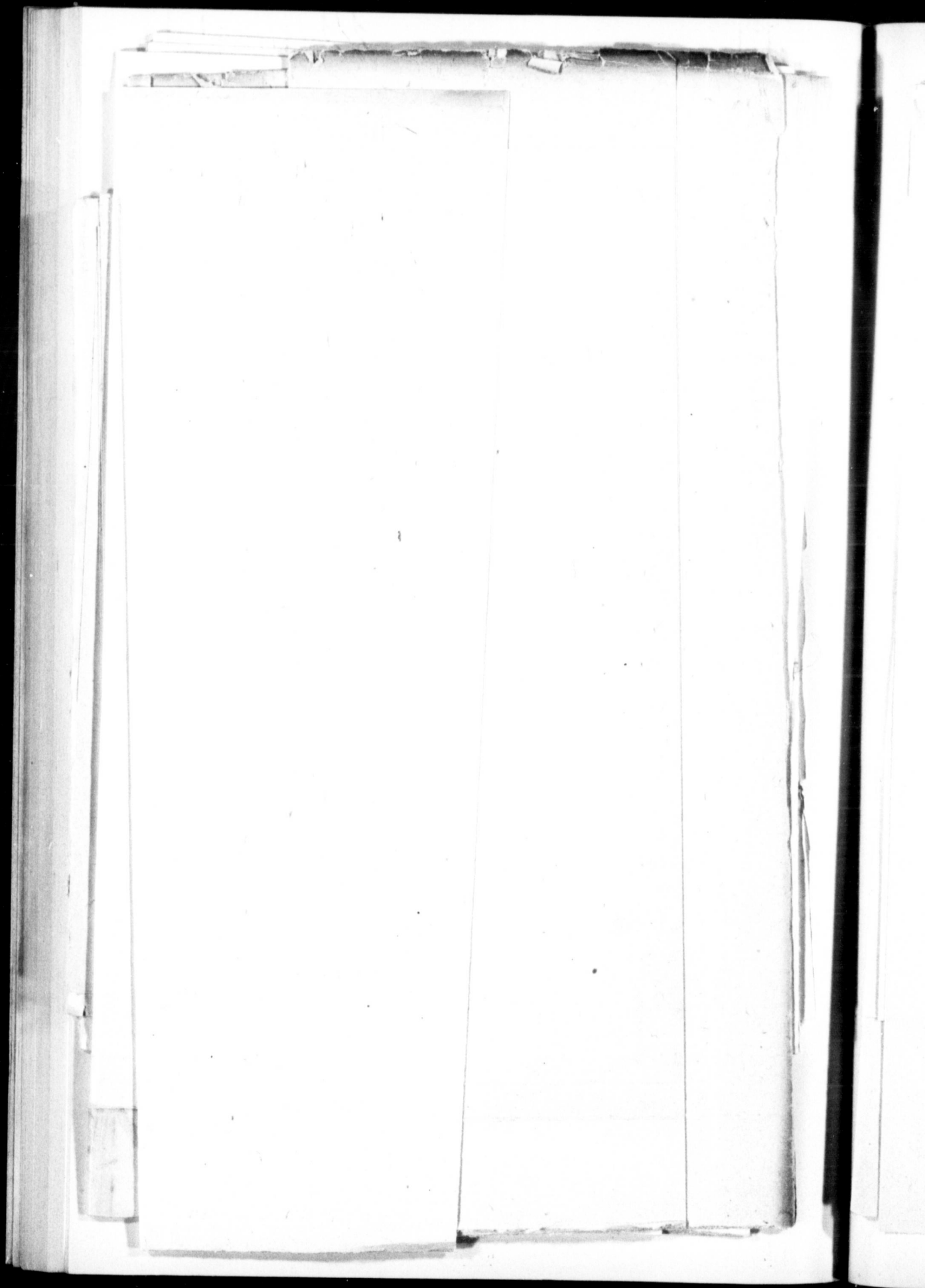


## OLDHAM GOLD MILL

OLDHAM DISTRICT  
NOVA SCOTIA  
1891.

Scale 1/2 Inch = 1 Foot.



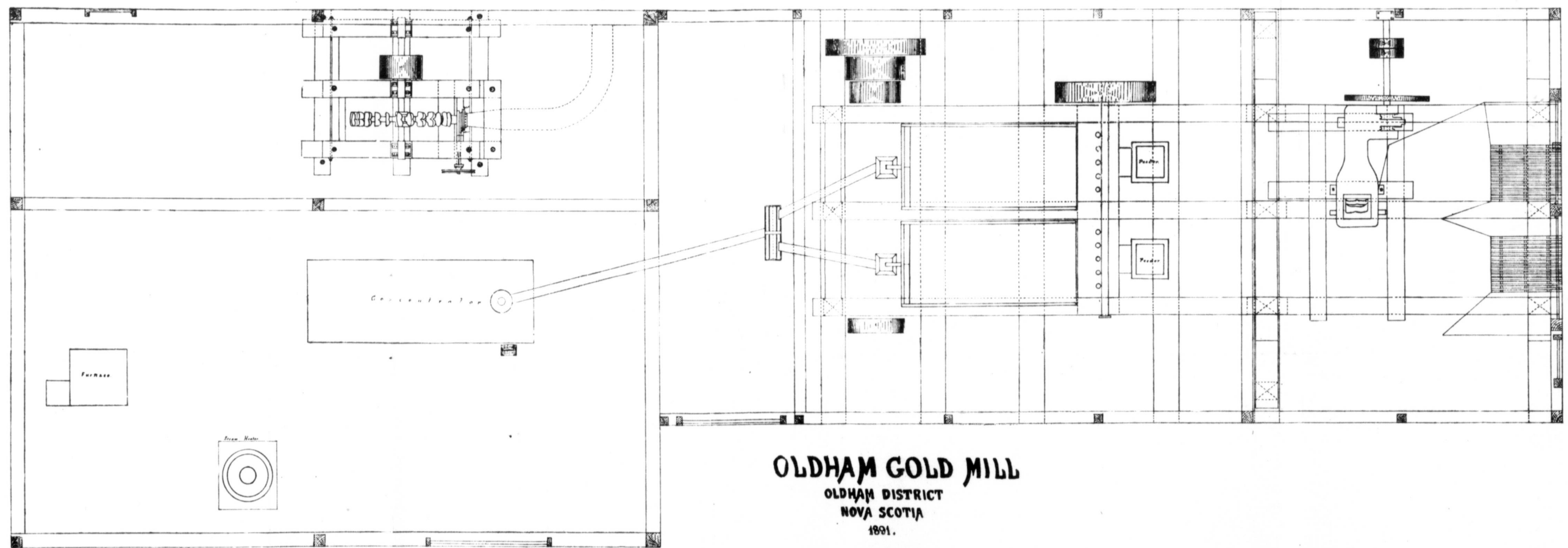




# TRANSACTIONS OF THE MINING SOCIETY OF NOVA SCOTIA

To Illustrate Mr. John E. Hardman's Paper,

"RECENT GOLD MILLING PRACTICE IN NOVA SCOTIA."



**OLDHAM GOLD MILL**

OLDHAM DISTRICT  
NOVA SCOTIA  
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**PLAN**

Scale  $\frac{1}{4}$  Inch = 1 Foot.



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# TRANSACTIONS

OF

## The Mining Society of Nova Scotia.

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PART III.

VOL. I.

SESSION 1892-3.

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The second Quarterly General Meeting of the Society was held at Londonderry on Wednesday, 7th September. There were present: H. S. Poole, F.G.S., A.R.S.M., Acadia Coal Co., Stellarton; David McKeen, M.P., Caledonia Coal and Railway Co., Sydney, C.B.; John F. Stairs, M.P., New Glasgow Coal, Iron and Railway Co., Halifax; John E. Hardman, S.B., Oldham Gold Co., Oldham, N.S.; B. C. Wilson, Waverley N.S.; T. R. Gue, Acadia Powder Co., Halifax; A. Kent Archibald, Dufferin Gold Co., Truro; J. R. Lithgow, Glace Bay Mining Co., Halifax; J. H. Austen, Lawrencetown Gold Co., Halifax; Capt. G. MacDuff, Waverley, representing Crawford Milling Process; G. E. Francklyn, General Mining Association, Ltd., Halifax; G. F. Moncton and T. L. Jenner, Sherbrooke; Duncan McDonald, Truro Foundry and Machine Co., Truro; D. W. Robb, Robb Engineering Co., Amherst, James Baird, Canada Coal Co., Maccan; H. P. Brummell, Geological Survey, Ottawa; W. H. Huggins, Halifax; Frank Cawley, Ingersoll Rock Drill Co., Halifax; H. M. Wylde, Secretary of the Society, Halifax, and B. T. A. Bell, Editor CANADIAN MINING REVIEW, Ottawa. The main party having arrived by the morning train from Halifax was received by the following gentlemen, composing the local reception committee; Mr. R. G. Leckie, General Manager Londonderry Iron Co., Ltd.; Mr. E. Walsh, Mr. George Romans, Mr. W. F. Jennison, Mr. L. H. Buck, Mr. William Small, Mr. Boutellier, Superintendent of the West Mines; Mr. F. Park, Superintendent of the East Mines, and the Rev. Dr. Walsh.

The proceedings opened at 12 o'clock in St. Bridget's Hall, the President, Mr. H. S. Poole, being in the chair. On the platform, which had been tastefully decorated for the occasion, were seated, besides the chairman, Mr. David McKeen, M.P., and Mr. John E. Hardman, Vice Presidents of the Association, and Mr. R. G. Leckie, General Manager of the Londonderry Iron Co., (Ltd.)

MR. E. WALSH—Mr. Chairman and members of the Mining Society of Nova Scotia: Allow me to tender you on behalf of the citizens of Londonderry, a very hearty welcome. Every one in this community is interested in the welfare of your Society, and looks forward to its advancement. You have a lengthy programme to go through, so I will make my remarks short, merely bidding you all a hearty welcome to Londonderry.

THE CHAIRMAN—Mr. Walsh and Gentlemen of Londonderry: I am sure that the Mining Society cannot be but deeply gratified at the reception given its members to-day, supplemented as it is by the knowledge that behind it is to come an excellent programme of instruction and entertainment.

After a paper on "The Roasting and Smelting Plant at the Londonderry Works," by Mr. R. G. Leckie, General Manager of the Londonderry Iron Co., the remainder of the forenoon was spent in an enjoyable visit to the works of the Company, after which an excellent luncheon provided by the ladies of the town was served in the hall. On re-assembling, papers were read by Mr. R. G. E. Leckie and Mr. William Smail. These are published elsewhere in the present volume. The Secretary having read the Minutes of the previous meeting, the following business was taken up.

#### Revision of Constitution.

MR. JOHN E. HARDMAN said: It is the opinion of the sub-committee that the present time is not opportune for a revision of the Constitution and By-Laws, and they therefore recommend that any such be withheld for the present. They would recommend that the following lists be adopted as the classification of members and associate members. (Names submitted.)

MR. J. F. STAIRS, M.P.—The distinction seems to me to be one without any difference.

MR. J. H. AUSTIN moved, seconded by Mr. J. R. Lithgow: "That the report of the sub-committee be confirmed."

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MR. HOWARD CLARKE—As this is not a full meeting, I would move in amendment: "That the classification of the list as reported by Mr. Hardman be deferred until another meeting." Mr. Clarke's motion not being seconded, Mr. Austin's motion was put to the meeting and adopted.

MR. B. T. A. BELL gave notice of motion to amend Section III. of the Constitution and By-Laws, by classifying the membership into (1) Honorary Members; (2) Members; (3) Associate Members; and (4) Associates.

#### The Mining Convention in Montreal.

THE CHAIRMAN—Is there anything further to report in this matter?

MR. B. T. A. BELL—I might say that the General Mining Association of Quebec has made application for some government aid, but no reply having been received yet, there is nothing new to submit. Our Association hopes to be able to make its report to your Society some time in October.

#### The Society's Transactions.

MR. B. T. A. BELL submitted for approval, in proof form, the proposed volume of the Transactions at the First Quarterly General Meeting.

MR. HARDMAN—The Council has already approved of the get up of the Proceedings, as submitted by Mr. Bell; it only remains for this meeting to ratify their action.

On the motion of Mr. J. F. Stairs, M.P., the form of publication was adopted.

#### The Society's Seal.

The question of a seal for the Society was discussed at some length. Several sketches of designs were submitted. The matter was ultimately left for final adoption in the hands of the Chairman and Mr. Hardman.

#### The World's Fair.

The Secretary read the following letter from Dr. E. Gilpin, Jr., Inspector of Mines:—

NOVA SCOTIA, August 23, 1892.

H. Wylde, Esq.,

Secretary Mining Society of Nova Scotia.

DEAR SIR,—I enclose you circular *re* Chicago exhibit, and beg to draw your attention more particularly to the "gold" exhibits. As the matter is one of direct importance to your members as individuals, I feel that I may venture to address you officially. My time is so fully occupied by my dual duties of Inspector and Deputy Commissioner, that it is almost impossible for me to do justice to our minerals

in this connection. Would your Institute feel disposed to assist me in the collection of a good representation of gold ores? I want to show at least \$10,000 worth of gold ore, and as much more as I can get.

If your Institute feels disposed to view the subject with favor, I would be pleased to give any information I have at present as to forwarding, etc.

I remain yours, etc.,

E. GILPIN,  
Inspector of Mines.

On the motion of Mr. Hardman, Dr. Gilpin's letter was laid on the table for further consideration.

#### New Members.

The following gentlemen were elected to membership: J. C. McDonald, Country Harbor, N.S.; J. W. Clendenin, New York; J. A. Fraser, New Glasgow, N.S.; Frederick Taylor, Lowell, Mass.; John Daw, London, England; R. Pratt, C. E., Halifax; Dr. Falconer, Sherbrooke, N.S.; Frank Cawley, Halifax, N.S.

#### Report of Coal Royalty Committee.

Mr. J. R. Lithgow submitted printed copies of Petition on behalf of the Glace Bay Mining Company, to the Governor-General-in-Council. He also presented the following report of the sub-committee, which was adopted:—

*Report of the Committee on the proposed Memorial to the Governor-General-in-Council, asking for Disallowance of the Bill passed by the Nova Scotia Legislature increasing the Coal Royalty.*

LONDONDERRY, 7th Sept., 1892.

To H. A. Budden, Esq.,  
Chairman Committee on Coal Royalty.

The undersigned beg to report that early in July last they informed Mr. R. L. Borden that the Cape Breton Colliery Association and others interested, desired him, in concert with Messrs. Hugh McD. Henry and Arthur Drysdale, to draft a memorial as above.

The learned counsel named, after consultation, decided that two or three memorials would be advisable in order to more clearly present the somewhat diverse cases of the memorialists, as some of their leases or renewals contained different terms and provisions.

Herewith we beg to submit half a dozen printed copies of a memorial received yesterday from Mr. Henry, suited, he said, for such memorialists as held renewals in which was the "increase or diminish" clause. Another form of memorial, slightly different, had been determined on, but not yet printed, suited to the case of those whose leases contained the "revise and alter" clause.

The Glace Bay Mining Co's. case being different from that of other lessees, they will have a separate memorial, a draft of which is herewith submitted.

H. S. POOLE,  
J. R. LITHGOW,  
Committee on Memorial.

This terminated the business of the Session, and the members adjourned to the Station. While waiting for the Truro train, Mr. John F.

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Stairs, M.P., took occasion, in a graceful speech, to return the hearty thanks of every member of the Society to Mr. R. G. Leckie and his able executive for the exceedingly handsome manner members of the Society had been received and entertained. The meeting had been thoroughly successful, everyone had greatly enjoyed the outing, and he was sure they would all look forward to the time when the Society would visit London-derry again. Mr. R. G. Leckie and the Rev. Dr. Walsh replied. As the train steamed out of the station the members raised a cheer and joined heartily in a verse of "Auld Lang Syne." At eight o'clock the members dined together at the Prince of Wales hotel, Truro. The proceedings were of an entirely informal nature.



## ROASTING AND SMELTING PLANT AT LONDONDERRY IRON WORKS.

BY R. G. LECKIE, M.E., LONDONDERRY, N.S.

This paper is merely a description of the plant erected here during the last two or three years. I may say the furnace has given every satisfaction, the best average being 566 tons, of which 90 per cent. was No. 1 pig.

The ore deposits of Londonderry have been frequently described, and the paper to follow this will enter fully into their nature and composition. The oxidised ores unquestionably result from the decomposition of the carbonate ores, which form large but irregular masses in the mountain range which traverses Colchester County from west to east, continues through Pictou County, and bears in the same formation in Guysborough County the specular ores which to some extent have been worked near the Atlantic coast.

Samples of specular ore from Five Islands, the westerly boundary of the County, are identical with those mined in Guysborough Harbour, but the deposits are usually small and irregular. The deposits known as limonite or brown hematite are the most extensive, and vary in richness as much as they do in colour and form.

The carbonate ores are not fit for furnace use, but have to be reduced to the condition of oxides. Hence the attempt to accomplish to some extent in an artificial way what nature has been slowly but thoroughly doing through an unknown length of centuries.

The kilns in which the carbonate ores (a mixture of sideroplesite and ankerite) are calcined, are a modification of the gas roasting furnace first introduced by Westmann in Sweden. Both vertical and horizontal sections are shown in accompanying drawings. The total height of kiln from floor to charging door is 28 ft.; diameter at top 13 ft.; diameter at base 18 ft. In the centre is a circular brick wall 13 inches thick, enclosing an air space 36 inches in diameter. This opens at the top into a chimney and assists in drawing the gases and products of com-

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bustion laterally through the ore by twelve ports 12" x 2½", situated a little above the line of gas ports. The gas ports are 16 in number, and in front are 10" x 8", but flare back so that in the interior there is but a point of fire brick 3" wide separating them. This is divided by a fire-brick partition so as to give a more uniform distribution of gas and flame. The gas is admitted by a double opening in bottom of port, covered by a loose plate of cast iron, which can be readily moved so as to regulate admission of gas. Formerly gas was made in producers, but now waste gas from blast furnace is brought over in wrought iron pipes 18" in diameter, and distributed around the kiln by a cast iron pipe, containing openings for cleaning and removing dust carried over in gas current.

The carbonate ores are used not alone for the iron contained, but also on account of their earthy constituents, which form a very desirable flux. The raw ore, when charged into the kiln, contains on an average about 23% metallic iron, and when thoroughly calcined carries about 33% after carbonic acid (CO<sub>2</sub>) has been expelled.

Under normal conditions, each kiln can treat daily (24 hours) 60 tons of raw ore, but over 80 tons have been put through and perfectly calcined when good gas was employed.

Two men are employed per shift on each kiln, one charging on platform and one attending to gas and drawing ore.

The ore is wheeled direct to the scales and is charged into the furnace while still hot.

The blast furnace was rebuilt in 1890, and in April of that year was blown in. It is of the ordinary type, having a height of 75 ft.; bosh 18 ft.; diameter of hearth 9 ft.; diameter at stock line 14 ft.; and of bell, 10 ft 6 in. It is blown with 7 tuyeres, 4½" diameter. The gas down-take is 4' 6" in diameter, and the dust catcher is a circular iron chamber 25 ft. high by 10 ft. diameter. Inside it has two diaphragms, between which the gas passes downwards and then rises up behind these diaphragms to a gas conductor which on one side leads to boilers and kilns and on the other to the hot blast stoves. The gas in its travel through the dust catcher deposits a large amount of dust, which enables the stoves to run for nine months without cleaning, instead of for three months, as was the case before its introduction. The bell of furnace is also novel. Instead of being a plain cone, the periphery is indented—that is a space 8" wide alternates with a plate 12" wide, which enables a more regular distribution of the fine and coarse ore to be made.

Although the bell is 2 ft. larger in diameter than the hopper it was put in without removing it. The bell was cast in two pieces, that is, a section was cut off by an interposed slip, and after main portion had been swung into place, the cut out portion was replaced and the two bolted together by raised flanges on upper side.

Since the introduction of this bell, the hanging and slipping which had previously given so much trouble and caused irregularity in working ceased. The tuyeres also, which had been frequently destroyed, now give little trouble.

The removal of slag is an important item in cost, and the experiment now in operation appears to answer well. It is simply an adaptation of the tail-rope system to the slag car. Further improvements are in contemplation, which will make the discharge of slag automatic, and so reduce to a minimum the handling of slag.

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IRON DEPOSITS OF TORBROOK.

*IRON DEPOSITS OF TORBROOK.*

BY R. G. E. LECKIE, C.E., TORBROOK, N.S.

In bringing before you the subject of the iron deposits of Torbrook it will be as well to first give a general idea of the geological formation of the surrounding country and a rough sketch of the iron deposits of Annapolis and Kings Counties generally.

Skirting the northern edge of the counties, and forming a portion of the south shore of the Bay of Fundy, is a range of hills called the North Mountain. The range rises to a height of from four to five hundred feet above sea level, and is of Triassic trap formation. Considerable magnetic iron ore is found in this trap, occurring in parallel veins, running longitudinally with the axis of elevation and varying in thickness from six inches to four feet. Some splendid crystals of magnetite may be obtained from this locality. Unfortunately the iron veins are filled with a large number of quartz nodules, which make the ore practically valueless.

The South Mountain range is from six to eight miles south of the North Mountain and runs parallel to it. According to Dawson this latter range was caused by an upheaval of granite during the Upper Devonian period. Here we find the slates and quartzites of the lower Devonian strata, folded into synclinals and anticlinals, and finally dipping into the granite as if it had subsided, at the time of eruption, into the plastic mass. At the junction the Devonian rocks are greatly metamorphosed. Lying between the North and South Mountains is the fertile plain which constitutes the Annapolis Valley, and down the centre of which flows the Annapolis River. Here we find a formation of recent sandstones and conglomerates, lying in horizontal beds, and resting unconformably on the trap and Devonian slates on either side.

Deposits of bog ore have been found on the surface throughout the valley, but more especially in the eastern end of it, where it lies between the South Mountain and the Annapolis River. Some leases have been

taken by Americans along the South bank of the river, but as yet the deposits remain entirely undeveloped. The lower or western end of the valley is covered with marsh mud, and no bog ore so far as known has been found there.

But it is on the South Mountain, in the Devonian rocks, where lie the rich and abundant deposits of magnetite and red hematite that are destined to bring Annapolis County, some day, to be the leading iron producing district in the Province.

Beginning at the Western extremity of the County, at Clementsport, on the Moose River, is found a fossiliferous magnetic ore, which has been worked there to a considerable extent. Operations had been carried on in this locality previous to 1830, then, after a stoppage of over thirty years, were again resumed. A charcoal hot blast furnace had been erected and in the year 1862 five tons a day were being turned out. (How's Mineralogy.) The bed here is from 7 to 9 feet in width; but the ore is unsatisfactory, being high in both phosphorus and sulphur.

Thirty miles east of Moose River we come to Nictaux, where several large beds of magnetic ore are exposed; east of which lies what may now be called the "Torbrook Iron Deposits." The Torbrook district may be bounded as follows: On the north, by a line running east and west, which would mark out the junction of the valley sandstones with the Devonian rocks of the South Mountain; on the East, by the Vails River, in King's County; before reaching this river, the strike of the veins have carried them out into the valley under the sandstone beds; on the South, by a line running along the summit of the mountain and marking out the junction of the Devonian and granite formations; on the West, by the Nictaux River, where a large fault occurs, throwing the Devonian formation out into the valley; it has been denuded and probably underlies the valley sandstones.

The strike of the iron ore beds or veins runs diagonally across the oblong district thus indicated—the general direction being N. 60° E.

There are four known veins of red hematite, which have been traced for the most part right across the whole district, a distance of about five or six miles. For convenience sake we will number these 1, 2, 3 and 4, beginning at the North.

No. 1 vein is the most important of the four, and is the one which is being worked at the Torbrook mines. The dip is south, and varies from 70° to 80° from the vertical. The vein is very regular in width,

having an average thickness of 10 feet, there being no other veins of this kind. The rock is variegated talcose slate and bluish slaty country rock. It is noticeable that the No. 2 vein occurs in the surrounding slate.

No. 2 vein is 100 feet wide and 100 feet long, exposed by open cut for 100 feet.

The following is a former rector of the school from How's Mountain, situated on the South Mountain, a large extent with natural calcareous well defined imbrication often found in the shell. The vein is for some three or four miles long.

Dr. Robert How's is being the same as the No. 2 vein.

This "shell" is on the Moose River, but in a disturbed condition to the locality and is called "How's Mountain." This vein is a streak; however, it is by its proximity to the magnetic. How's ore is a red hematite and called special structure of special.

No. 3 vein is 100 feet wide and 100 feet long, outcrop of which is 100 feet. This vein is the same as the No. 2 vein.

having an average thickness of six feet. The ore is perfectly clean, there being no slate or stone between the walls. The walls are of a variegated talcose slate: white, bluish and pink in colour—the white and bluish slate predominating. There are about 18 inches of this talcose slate on the hanging wall, and two feet on the foot wall. The country rock is a harder dark blue slate, spotted with red iron stains. It is noticeable that this bed of ore is entirely free from shells, while No. 2 vein over-lying, less than 100 feet south, and several beds of the surrounding slate, are highly fossiliferous.

No. 2 vein, or the "Shell Ore" vein, as it is called, lies between 60 and 100 feet south of No. 1 vein. This was the vein that was worked by open cut for many years to supply the old furnace at Nictaux Falls.

The following remarks on this bed of ore by the Rev. Dr. Robertson, a former rector of Wilmot, and an enthusiastic mineralogist, is taken from How's Mineralogy. "The vein that has hitherto been worked is situated on the east side of the River Nictaux, and is intermixed to a large extent with petrified marine shells. These shells still contain their natural calcareous properties. They are very clearly marked, leaving a well defined impression in the matrix of the minutest lines. They are often found in clusters, so compact and homogeneous that one might imagine the whole to be formed originally from one vast bed of shell. The vein is about ten feet wide, or thick, and is found to extend for some three or four miles."

Dr. Robertson is rather at fault as regards the width of the vein, it being the same width as No. 1, from 6 to 8 feet.

This "shell ore" vein may possibly be the same vein as is worked at Moose River, but the connection has not been traced, on account of the disturbed condition of the intervening ground. The shells are peculiar to the locality and have been named by Dawson the "*Spirifer Nictaensis*." This vein is in reality a red hematite giving a decided red streak; however, at the western end it has been slightly metamorphosed by its proximity to the igneous rock, causing it to be somewhat magnetic. How, in his Mineralogy, calls it specular ore. Specular ore is a red hematite in composition, being the sesquioxide  $Fe_2O_3$ , and called specular on account of its structure. This has not the structure of specular ore.

No. 3 vein is about three-quarters of a mile south of No. 2, the outcrop of which appears half way up the side of the South Mountain. This vein is the same in width and structure as No. 1, the only differ-



ence being that it is somewhat magnetic in character, and has a darker streak—a reddish brown colour. The dip of this vein is almost vertical, but, if anything, dips slightly north.

It almost looks as if it were a second outcrop of No. 1 vein, on account of the similarity. It would seem as if it were the southern outcrop of a synclinal, but as yet no vein corresponding to the shell ore vein has been found north of it, without which we could hardly prove the correctness of the assumption. However, the point cannot be proved without a thorough geological survey being made of the district. The workings in the Torbrook mine are not yet deep enough to throw much light on the subject, although the dip seems to flatten a little even at the comparatively slight depth of 120 feet.

No. 4 vein in all probability lies about a quarter of a mile south again of No. 3 vein. It has been opened on Messenger's property, almost on King's County line, a distance of 2 miles east from the Torbrook mine, and following the strike, it would bring the vein much farther up the mountain than No. 3. Boulders have been found all along its probable course, which is almost conclusive evidence that it exists there. On opening up the vein it was found to be of the following dimensions:—

	Feet.
Ore.....	2
Slate.....	3
Ore.....	1

The walls are the same as No. 1 in composition; being a talcose slate.

**Description of Working at Torbrook Mines.**

The Torbrook mine is situated at the foot of the South Mountain, 3 miles from Nictaux River, and 2 from the King's-Annapolis County line. Many have confused this mine with the Nictaux mine, which is on the western side of the Nictaux River. The workings there are in a magnetic ore bed, 8 feet wide, which is high in both phosphorus and sulphur. Over two years ago, leases of all the available property in the Torbrook district were taken up by the Torbrook Iron Co., and work was commenced in the fall of 1890. Active operations did not, however, really begin until the spring of 1891, when steam hoisting plant was put in and ore raised from two shafts (now No. 2 and No. 4). One of these worked by back-stopping the ore, while the other was worked "underhand." At the same time a survey was made from the mine to the Windsor and Annapolis Railway at Wilmot station,

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so as to connect the mine by rail. The Torbrook branch line was completed in the autumn, and immediately two more shafts were opened up (No. 3 and No. 5). No. 3 shaft worked underhand and No. 5 shaft back stopping. A four drum hoisting plant was put in during the winter of 1892 (last winter), and now does the hoisting for Nos. 3, 4 and 5 shafts. No. 2 shaft has a separate engine and boiler, it being the intention to hoist from that shaft with steel skips having the capacity of over a ton.

The mine has lately been equipped with an air drill plant, which enables the output to be materially increased :—

	Tons per day.
Output, Spring 1891, about.....	20
Output, Spring 1892, about.....	70
Output at present.....	130

There is a Cornish "plunger plump" placed in No. 2 shaft. No. 4 and No. 5 shafts are kept dry by small steam "Blake" pumps.

The following are some analyses of various samples of ore, taken from the mine :—

	No. 1	No. 2	No. 3
Protoxide of iron.....	27.09	....	....
Sesquioxide of iron.....	49.52	....	....
Oxide of manganese.....	.60	....	....
Silica.....	13.46	10.22	10.28
Lime.....	7.00	....	....
Alumina.....	1.90	....	....
Magnesia.....	1.80	....	....
Sulphur.....	trace	....	....
Phosphorus.....	trace	....	.399
Metallic iron.....	.74	59.76	60.72

*NOTES FROM LABORATORY ON SOME IRON ORES FROM NOVA SCOTIA.*

BY WM. SMAILL, LONDONDERRY, N.S.

Glancing at a map upon which the occurrence of different minerals of this Province are marked, one will notice that the main deposits of iron ore seems to be confined to a band about twenty miles wide inland from the Bay of Fundy, starting in at Digby and continuing in a north-easterly direction to Colchester County; here taking a more easterly course through Colchester, Pictou and Antigonish Counties, when it again resumes its northerly course through the central parts of Cape Breton. It is found in rocks of the Triassic, Carboniferous, Devonian, Silurian, and Laurentian.

Naturally, the different chemical and mechanical processes—giving rise, first to the formation; secondly, the concentration of these ores into economic deposits—which have been going on through these ages forming beds and veins of ore, have taken place at different periods of time, and under many varied conditions, thus yielding different results both chemically and physically.

Iron ores may be classed as follows:—

- |                 |   |                 |   |                                      |
|-----------------|---|-----------------|---|--------------------------------------|
| I. OXIDES ..... | { | Anhydrous ..... | { | Magnetite.<br>Hematite.<br>Titanite. |
|                 | { | Hydrous .....   | { | Limonite.<br>Bog Ore.<br>Turgite.    |

- II. CARBONATES { Siderite; Ankerite; Clay Iron-Stone; Black Band.

**Magnetites.**

The most important deposits are found in the Triassic, Devonian, and Laurentian, of Annapolis County and Cape Breton. These deposits are now looked upon as being of sedimentary origin, and not eruptive. They may have been formed in the same manner as bog ores, the accumulation of iron sands, or the metamorphism of pre-existing

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MnO<sub>2</sub>  
SiO<sub>2</sub>



ores. This latter fact is well illustrated in the manufacture of so-called metallic paint from bog ores, ochres, &c. These contain organic matter, which, in the subsequent calcination, reduces a certain portion of the ferric oxide to ferrous state, the result being a magnetic oxide of iron. The magnetites of Annapolis County are best known, being the first ores to be smelted in the Province. At Clementsport a furnace was erected in 1831 to smelt the ore occurring in the Devonian of that vicinity. Two principal beds were worked, the ore yielding from 30 to 50 per cent. of iron. At Nictaux two varieties of magnetite are found: one fossiliferous and partly magnetic, the other a dense compact variety. From many analyses I find that these ores run

Iron .....	From 40'00%	to 65'00%
Silica .....	" 9'00%	to 15'00%
Sulphur .....	" 0'40%	to 0'80%
Phosphorus.....	" 2'00%	to 5'50%

containing also varying amounts of lime, magnesia, and alumina.

The compact variety, which is much the better of the two, has been tried here, but owing to the kilns then in use, which did not give a thorough calcination, the result was an iron rather unfit for foundry purposes, and its use was promptly abandoned. Probably if the ores were well broken up and a better selection made, with the new and improved kilns now in use they would prove valuable ores for certain classes of iron.

A deposit occurs at Digby said to be of considerable size, and comparatively free from sulphur, phosphorus, or titanium, yielding from 40 to 50 per cent. of iron.

Between Economy and Five Islands, Colchester County, at Gerrish Mountain a quantity of ore was at one time mined for this place, and according to analyses it must have been a most valuable ore.

I have had many magnetites sent to me for analyses from almost every part of Cape Breton, but have never had reliable information as regards extent or true locality of samples. I will just state that they were generally high in iron, comparatively free from phosphorus but rather high in sulphur, and would thus necessitate roasting.

I.—MAGNETITES.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
FeO	23.88	21.76	70.72	.....	....
Fe <sub>2</sub> O <sub>3</sub>	63.79	48.34		.....	....
MnO <sub>2</sub>	0.08	0.40	.....	.....	....
SiO <sub>2</sub>	8.83	18.95	27.20	15.59	9.10

## MAGNETITES (continued).

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
CaO	0.11	4.01	1.20	.....	.....
Al <sub>2</sub> O <sub>3</sub>	trace	1.62	trace	.....	.....
MgO	3.27	0.60	0.937	.....	.....
S	trace	0.08	.....	0.025	0.028
P <sub>2</sub> O <sub>5</sub>	none	3.08	0.128	0.017	0.020
TiO <sub>2</sub>	none	none	.....	.....	.....
Iron	63.23	50.77	51.04	62.69	62.13

No. 1 from Five Islands (Smail).

No. 2 " Nictaux "

No. 3 " Digby "

Nos. 4 and 5 from Milbury.

**Hematites.**

The main deposits occur in the Palæozoic, both bedded and in veins. Many varieties of ore come under this head, but the different species depend more on physical conditions than chemical composition. Hematites are generally freer from impurities than magnetites, and are much easier to reduce. They are formed by the alteration of pre-existing deposits of other ores of iron or the pseudomorphous replacement of other minerals by iron. The supply of this class of ore in Annapolis County is said to be inexhaustible. Like the magnetites of this county we find two varieties present: a highly fossiliferous hematite known as "shell ore," rich in iron but too high in phosphorus to be used for manufacture of foundry iron; 2nd, a compact variety occurring at Torbrook, discovered about two years ago. The mines are now equipped with all the most modern appliances, &c., for the mining and handling of the ore. They are turning out something over a hundred tons per day, and the ores used in connection with limonites and spathic ores in works here, yield a very superior soft foundry iron, much prized by the foundry-man owing to the large amount of scrap it will carry in the cupola. A full description of these mines is given in the paper by Mr. R. G. E. Leckie, manager of the mines. The ore is a compact red hematite, somewhat silicious, with a perfectly tabular cleavage.

At East and West Mines of this place, hematites occur in many varied forms. A hard compact variety of specular ore, commonly called by the miners "black ore," is found in veins of all sizes traversing the ankerite, or as micaceous ore in pockets, scattered through the soft ochrey ores; the occurrence is well illustrated in the level at Cook's Brook, where the original carbonates are all decomposed into soft ochrey ores, and the specular is scattered in small stringers and

## LABORATORY

pockets all the original a in minute grains

Hematites

had small specimens although some regards the ore generally given samples is in

Pictou County

The main deposits mining operations furnace at Five Islands given by Messrs

Among the

Sydney and West Manchester and Annapolis County, and deposits of hematitic micaceous ores bedded and vein be given to the

FeO  
Fe<sub>2</sub>O<sub>3</sub>  
Al<sub>2</sub>O<sub>3</sub>  
SiO<sub>2</sub>  
MnO<sub>2</sub>  
CaO  
MgO  
S  
P  
TiO<sub>2</sub>  
BaO  
Vol  
Co<sub>2</sub>  
Iron

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No. 2, E  
No. 3, E  
No. 4, M

pockets all through, seemingly preserving the same position as in the original ankerite. Small quantities of magnetite are also found in minute grains scattered through some parts of this deposit.

Hematites are found in many parts of Hants County, and I have had small specimens from several parts which proved very pure, although somewhat silicious, but have no certain information as regards the extent, although as usual the most positive information generally given to any question of this kind from parties sending samples is invariably, "there is any amount."

Pictou County is well supplied with specular ores and red hematite. The main deposits are at East River and Sutherland's River, where mining operations are now being carried on to supply the new blast furnace at Ferrona. Full descriptions of these deposits have been given by Messrs. Gilpin, Harrington, and others.

Among other noted localities, I may just mention St. Peters, Sydney and Whyhogomah, C.B.; the specular ores of Roman Valley, Manchester and Melrose, Guysboro' County, at Lochaber, Antigonish County, and red hematite of Grand Lake, Halifax County. The deposits of hematite occurring in veins are generally specular and micaceous ores which are almost invariably of lesser extent than the bedded and vein deposits of red hematite, and most attention should be given to the latter.

2.—HEMATITES.

	No. 1.	No. 2.	No. 3.	No. 4.
FeO	.....	.....	8.80	.....
Fe <sub>2</sub> O <sub>3</sub>	79.42	77.14	66.60	99.78
Al <sub>2</sub> O <sub>3</sub>	5.08	7.41	8.12	.....
SiO <sub>2</sub>	12.00	5.30	9.45	0.13
MnO <sub>2</sub>	0.38	1.23	0.49	traces
CaO	1.90	0.49	2.50	0.02
MgO	0.35	0.57	0.49	traces
S	0.11	0.03	.....	0.11
P	0.43	0.08	.....	traces
TiO <sub>2</sub>	traces	.....	.....	.....
BaO	traces	.....	.....	.....
Vol	.....	7.80	2.85	.....
Co <sub>2</sub>	.....	.....	.....	.....
Iron	55.60	54.00	53.50	69.85

No. 1 from Torbrook, N.S. Sample taken from several cars (Smaill).

No. 2, Earthy Red Hematite (Turgite) West Mines (Smaill).

No. 3, Earthy Red Hematite (Turgite) Old Mountain (Smaill).

No. 4, Micaceous Ore, East Mines (Smaill).

## 3.—HEMATITES (continued).

	No. 5.	No. 6.	No. 7.
FeO <sub>2</sub>	.....	.....	.....
Fe <sub>2</sub> O <sub>3</sub>	75.80	75.67	92.01
Al <sub>2</sub> O <sub>3</sub>	4.19	0.45	0.21
SiO <sub>2</sub>	8.26	19.43	3.68
MnO <sub>2</sub>	0.65	0.52	2.16
CaO	6.30	1.37	0.71
MgO	.....	0.46	0.20
S	0.20	0.29	0.16
P	2.65	0.22	0.08
TiO <sub>2</sub>	.....	traces	traces
BaO	.....	.....	.....
Vol	1.66	.....	.....
Co <sub>2</sub>	.....	1.59	.....
Iron	53.06	54.36	64.41

No. 5, Fossiliferous Red Hematite (Shell Ore) from Nictaux (Smaill).

No. 6, East River Red Hematite (MacAdam).

No. 7, East River Specular “

**Limonites.**

Limonite proper occurs in true veins, and is the result of decomposition of pre-existing ores in situ. The deposits of most economic value discovered so far are those of Colchester and Pictou Counties. At Londonderry extensive mining operations have been carried on since 1849. The belt of ore has been traced from east of the East mines running west a distance of over twenty-five miles, varying from half to two miles in width. Ore occurs in rocks of the Middle or Upper Silurian. The veins are very irregular both as regards size and contents. As regards the origin and formation of these deposits, Sir William Dawson gives the following solution.—

1. Formation of fissure ;
2. Igneous formation of a deposit of iron, lime and magnesia carbonates ;
3. Breaking up these by faults and cross fractures ;
4. Partial roasting of contents ;
5. Action of heated waters ;
6. Action of the air and atmosphere.

The original deposits being altered under different conditions as regards time and agencies, the result being that we find almost all varieties of carbonates, hydrous and anhydrous oxides of iron present. Also the original vein stone in all stages of metamorphism. In the mining of these ores boulders of ankerite are met with, which almost invariably will be covered at sides and back with quantities of specular ore or limonite. The limonite often occurs in large hollow masses of irregular shape, which, when broken, contain water, and the inside surface presenting mammalated, stalactitic or botryoidal structures. Some-

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times brecciated masses of the country rock are found in the interior cemented together by the ore. Large concretionary balls of ore are also found which when broken in half show white ore in the interior and different zones of oxidation and even dehydration. In these lumps, just outside the ankerite, will be noticed a small quantity of ochre, then a thin ridge of compact limonite, or perhaps a whole series of concretionary bands of limonite surrounding one another, and between each layer small quantities of soft ochre, in some cases the whole mass covered with a layer of hard black ore. Large quantities of an ochre to a compact red hematite are mined which are newer than the limonites, being formed from a more recent decomposition of the ankerite. This mineral is really turgite, being a red hematite and invariably containing combined water. It is one of the most easily reduced ores and generally very pure, running as high as 58% metallic iron, any foreign matter generally being in the shape of lime or magnesia, which of course are deleterious elements. Since 15 years ago, when experiments were being carried on at the Newton works of the Steel Company of Scotland with the Danks rotary furnace, the lump ore used in the experiments was brought to Scotland from these mines. New levels have been opened lately; the ore mined and indications are very favorable indeed for future workings.

The limonites of Pictou County have been treated in full by several writers, much more competent to talk about them than myself. The ores of what is known as the East River district, are now being mined in large quantities for the coke furnace at Ferrona and charcoal furnace at Bridgeville. The principal deposits occur along the contact of Silurian and Carboniferous rocks. Ore is generally associated with calcite and small crystals of baryte. Some of the deposits contain notable quantities of manganese. Lumps have been received here at different times to be used as fettling in the mill. The iron contents averaged 50 to 55 per cent of iron.

Large quantities are also found near Brookfield resembling West Mines ore very much, some of which have been used here at mill and works with satisfactory results. The average of 15 cars was 45.15% metallic iron. A variety of a dark brown calcareous limonite occurs at Pugwash, some having been mined and tried here, but owing to the high manganese contents it is found to produce too hard an iron for foundry use.

I have had samples sent me lately from near Grand Lake, Halifax County, which the owner of the mine claims is a true vein deposit of limonite, but appearance, &c., of the ore incline me very strongly to think it simply a dip of bog ore.

Limonite occurs in many other localities of the Province, but only those of Colchester and Pictou Counties have received anything like the degree of attention they deserve.

#### Bog Ores.

These ores are of modern age, found in many places in Nova Scotia, and elsewhere, on the sites of old swamps at or near the surface, and generally in sandy regions.

They have been formed in many ways thus: Waters containing carbonic oxide permeating the older rocks containing ferruginous matter would dissolve some of the iron, find their way to low swampy regions where the water charged with organic matter and organic acids would combine with the iron. In course of time the water would become impregnated with these salts of iron, which would become oxidised at the surface of the water, forming a thin film, which gradually thickening as the process of oxidation went on until it sank, when another film would start forming, &c.; this process continuing would eventually result in a bed of ore, consisting chiefly of peroxide of iron, in combination with water and organic matter; or, again, rain water falling upon decayed leaves or vegetable matter, would take up the organic acid formed, and running down the sides of hills, &c., passing over any strata containing iron would dissolve some of the iron, and, finding its way to low regions, there becoming concentrated, as before mentioned, beds would be formed in the same manner. These classes of ores are among the principal ores used in Sweden and Norway, also at the St. Maurice forges in the Province of Quebec.

Manganese is almost always present, from mere traces up to 20 per cent.

Sulphur generally in only very minute quantities. Phosphorus from traces to 2 or 3 per cent. Combined water and organic matter from 15 to 35 per cent. It is this class of ores which generally form magnetite. They are found scattered all over the Province, in Annapolis, Halifax, Kings, Hants, Colchester, Pictou, and Antigonish Counties, also in Cape Breton.

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**Ochres.**

These are formed in the same way as bog ores, or are the result of decomposition of other ores of iron. Large quantities of these are not admissible in the blast furnace owing to the tendency to choke the furnace. They are found in almost every part of the Province, in greater or less extent. Generally called paint by miners. They are of all shades of colour from light yellowish to reddish brown and brownish black. Sometimes they are greyish when containing a large amount of ferrous oxide. When formed from the decomposition of ankerite, they generally contain micaceous specular ore, which often occurs in original ankerite. The light yellow variety is almost invariably the richer in iron, the darker variety seemingly containing more manganese.

<i>Light Yellow.</i>		<i>Dark Brown.</i>	
Iron,.....	62.64%	Iron, .....	36. %
Ins.....	traces.	Ins. ....	8.90%
Volatile,.....	10.60%	Volatile,.....	8.00%
		Manganese,.....	14.42%

These two specimens were from the same pit.

**Carbonates.**

*Siderite and Ankerite.*

Main deposits are at West and East Mines, Colchester County, and Sutherland's River, Pictou County. They are of igneous origin. Two main exposures are worked at East Mines to supply the furnace here; they are known as Slack's field and Totten Hill. Both are open quarries about half a mile apart, each being about a hundred feet long, fifty wide and eighty deep. Totten Hill contains more specular ore running through the mass than Slack's field, and is thus slightly higher in iron. These ores before being used in the blast furnace are calcined by new and improved kilns, which increases the value of the ore as regards the percentage of iron &c., 30 to 40 per cent. The value of this class of ore consists not so much in amount of iron it contains but in the valuable fluxing properties it possesses; 120 lbs. of calcined ore being equal to about 100 lbs. of limestone; cost of calcining is only about 10 cents per ton. The deposits at Sutherland's River, Pictou County, are of the same class, but have not been worked to any great extent as yet.

**Clay Ironstone.**

This is found in different parts of the carboniferous areas of the Province. The ore is a compact, argillaceous carbonate of iron,

greyish to black in colour. It is said to occur more frequently in Cape Breton. This class of ore is most largely used in England and Scotland in the manufacture of pig iron, but has not yet been found in any large quantities in Nova Scotia. The iron contents vary from 15 to 35 per cent.

**Black Band.**

This is found in all the coal measures in Nova Scotia. It is really a clay iron stone containing a large amount of organic matter. Both of these last varieties have been experimented with here, from Pictou County, but the parties sending did not seem to use enough discretion in sorting the clay and slate from the ore, which generally carried something over 2 per cent. of sulphur in the mixture.

It seems strange that Cape Breton, containing some of the most valuable coking coals in the Province, and reported to contain so much iron ore, should be so long in having any real information concerning extent and character of its deposits.

In conclusion the writer presents this paper to the Society, and the accompanying specimens, simply as a probable means of provoking discussion as to the general character and extent of the ores of the Province.

**Analyses.**

4.—BROWN ORES.

	No. 1.	No. 2.	No. 3.	No. 4.
Fe <sub>2</sub> O <sub>3</sub>	67.14	84.67	51.449	68.01
MnO <sub>2</sub>	1.67	0.17	0.871	5.67
SiO <sub>2</sub>	15.60	2.37	16.755	5.40
CaO	0.87	0.22	0.180	2.50
Al <sub>2</sub> O <sub>3</sub>	4.11	0.21	6.70	.....
MgO	0.12	0.13	0.125	.....
S	0.03	0.001	0.123	.....
P <sub>2</sub> O <sub>5</sub>	0.13	0.077	0.460	.....
Vol	10.37	11.54	10.11	16.30
H <sub>2</sub> O	23.00	0.45	25.00	.....
Iron	47.00	59.17	36.014	47.61

- No. 1, Average sample West Mines Ore. (Smaill).
- No. 2, Fibrous Limonite, West Mines. “
- No. 3, Paint from Old Mountain under turf. “
- No. 4, Pugwash, Calcareous Limonite. “

LABORAT

FeO 3  
MnO 2  
SiO 4  
CaO  
AlO 3  
MgO  
S  
PO 5  
Vol  
H<sub>2</sub>O  
Iron

FeCO 3  
MnCO 3  
SiO 2  
CaCO 3  
MgCO 3  
S  
PO 5  
AlO 3  
Iron

No. 1,  
No. 2,  
No. 3,  
No. 4,

FeO 3  
MnO 2  
SiO 4  
CaO  
AlO 3  
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S  
PO 5  
Iron

No. 1,  
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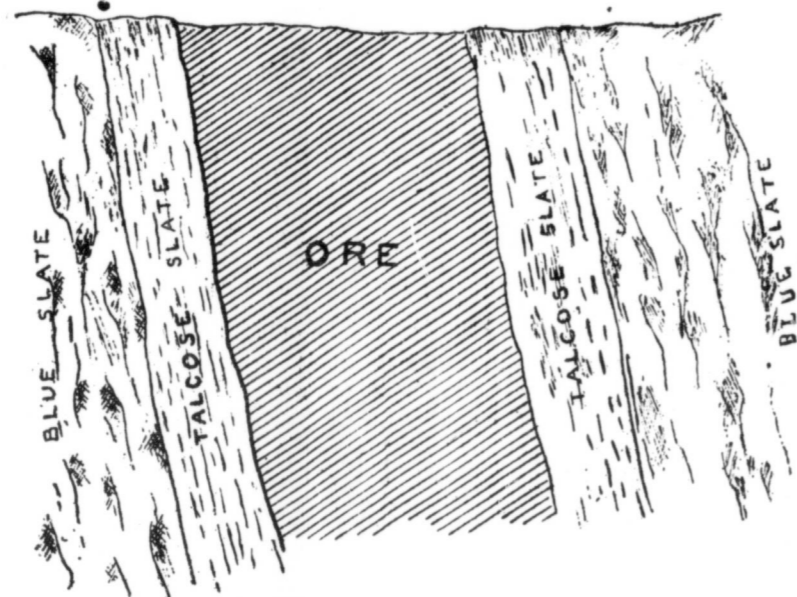
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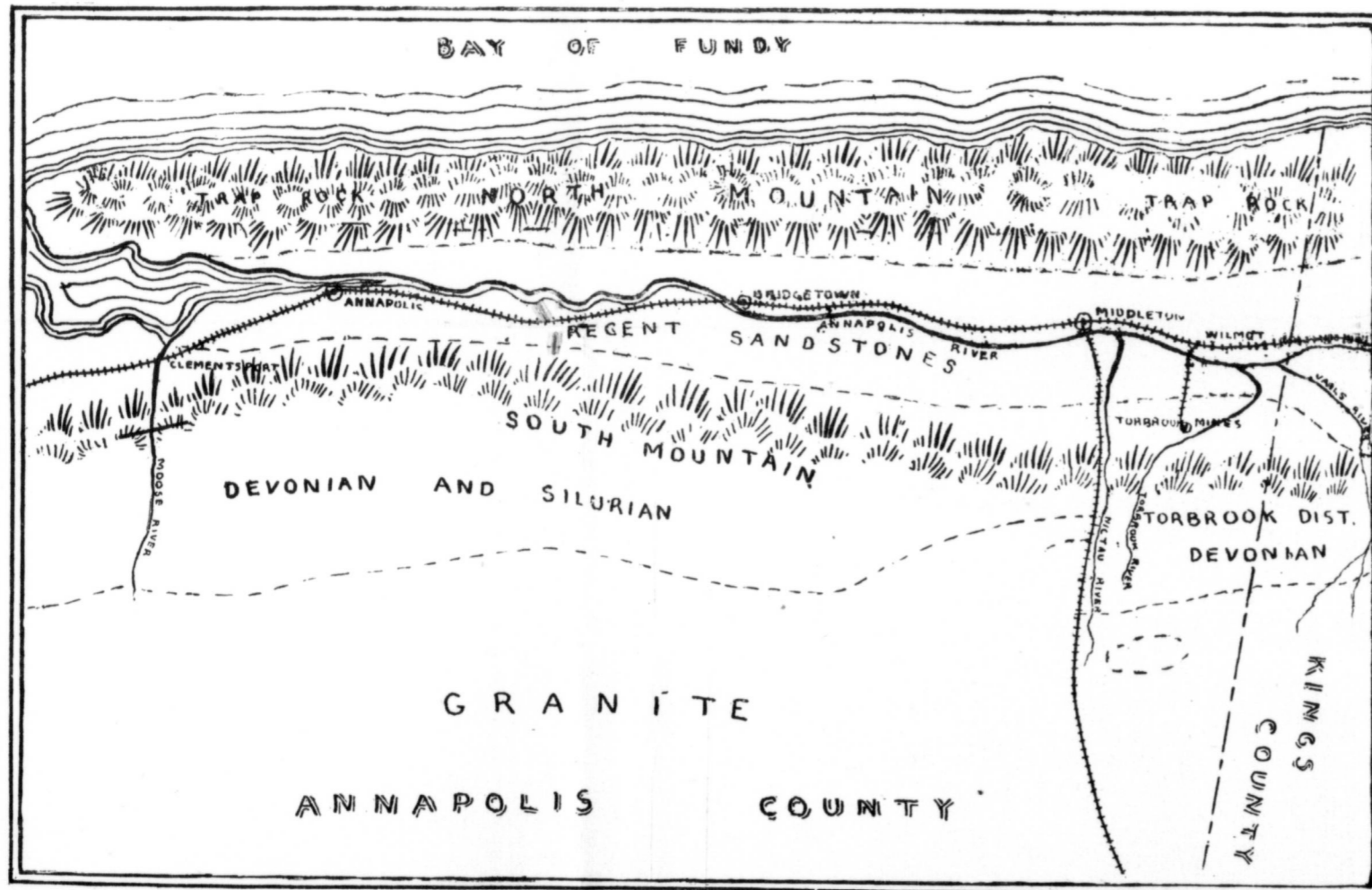
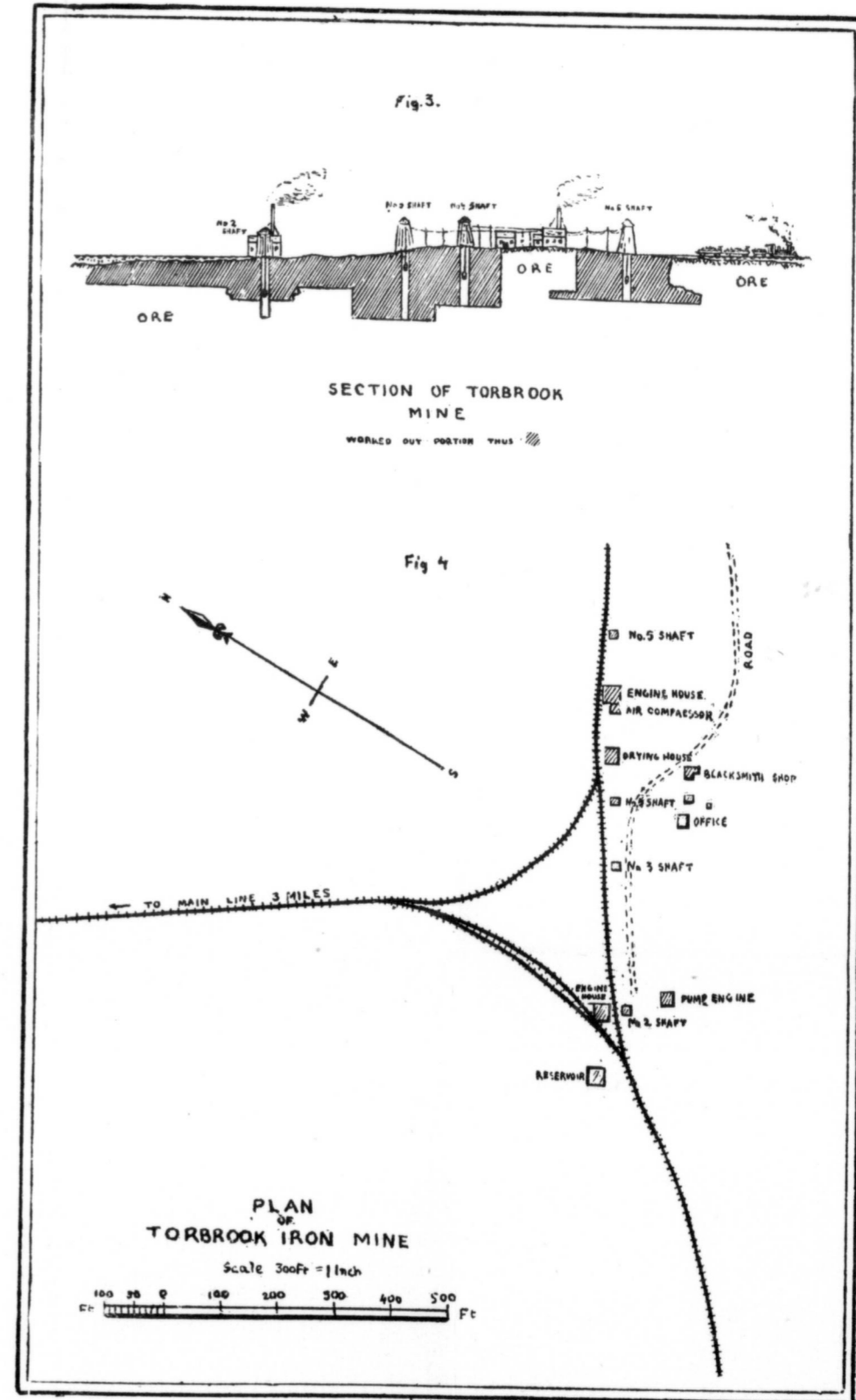
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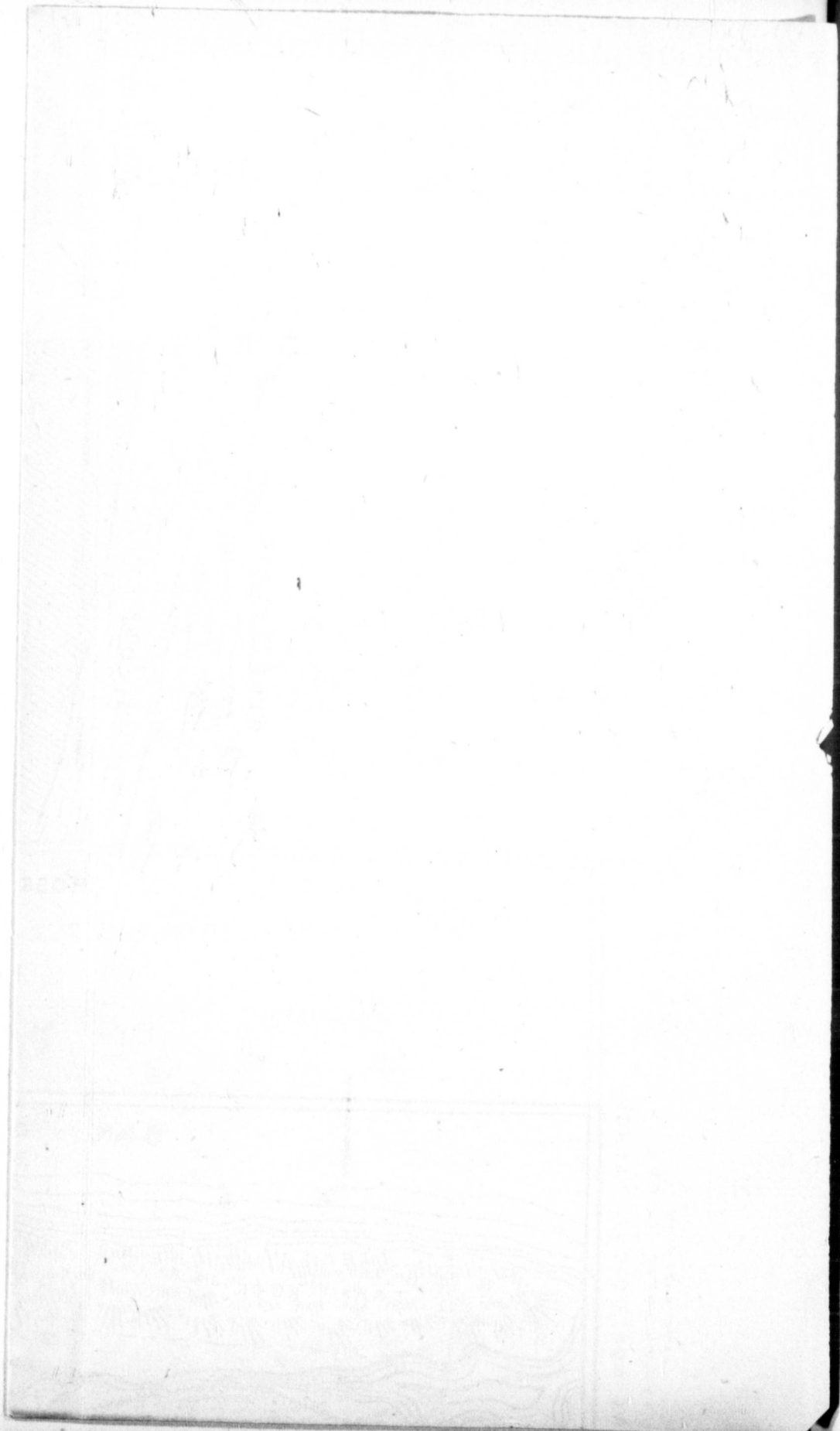
PLATES IV, V and VI.—Illustrating Mr. R. G. E. Leckie's paper on "The Iron Deposits of Torbrook."



CROSS SECTION OF VEIN  
Scale 4ft = 1inch







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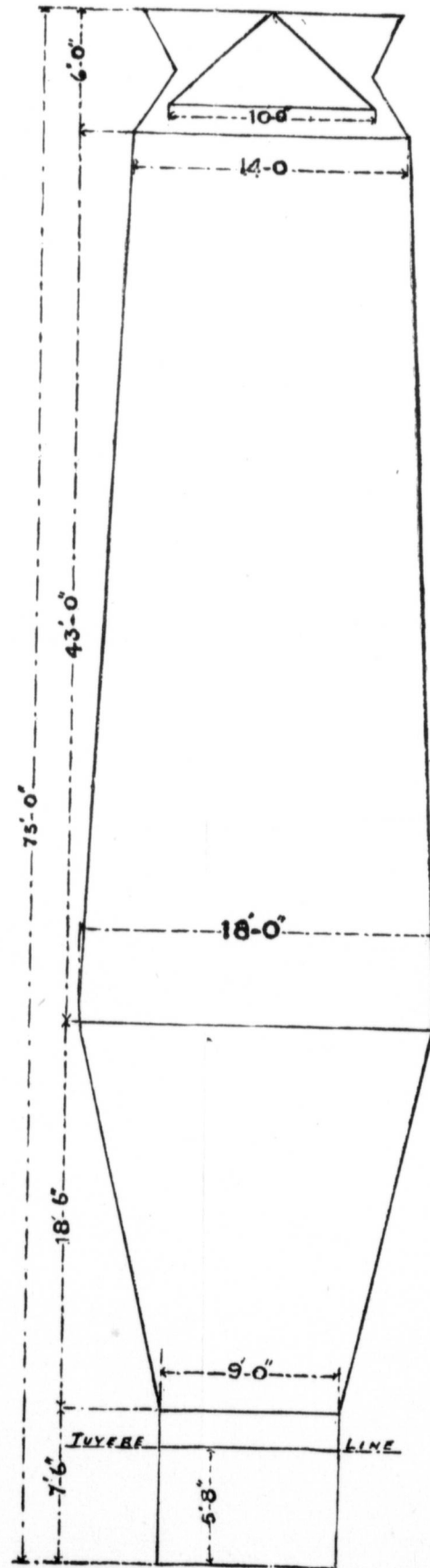
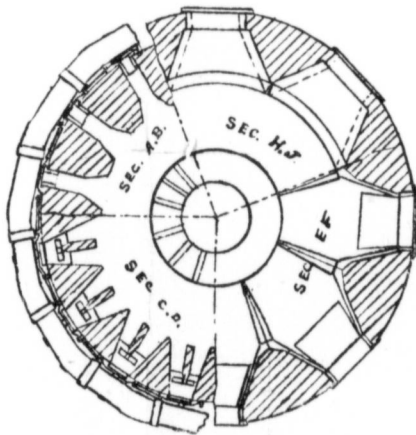
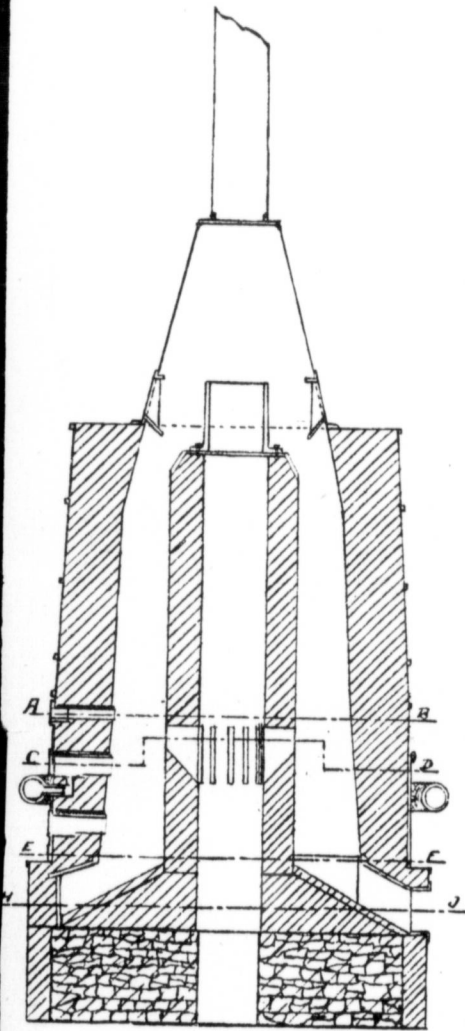
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TRANSACTIONS OF THE MINING SOCIETY OF NOVA SCOTIA,

Vol. I, Part III, Session 1892-93.

PLATES I, II and III.—Illustrating Mr. R. G. Leekie's paper on the "Calcining and Blast Furnace Plant of the Londonderry Iron Company, Limited."



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VOL. 1.

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TRANSACTIONS  
OF  
The Mining Society of Nova Scotia.

The Society as a body is not responsible for the opinions and views expressed in the several papers presented with the Transactions.

VOL. I.

SESSIONS 1892-93.

PART IV.

The December Quarterly Meeting of the Society was held in the rooms at Halifax, Thursday, 8th December. Proceedings commenced at ten in the forenoon. Mr. H. S. Poole, F. G. S., A.R.S.M., President, in the chair. There were present: John E. Hardman, S. B. Oldham; R. G. Leckie, M.E., Londonderry Iron Co., Londonderry; George W. Stuart, Truro Gold Mining Co., Truro; Duncan McDonald, Truro Foundry and Machine Co., Truro; James Baird, Canada Coal and Railway Co., Maccan; Wm. Smaill, Londonderry Iron Co., Londonderry; Charles Archibald, Gowrie Coal Co., Cow Bay, C.B.; R. H. Brown, General Mining Association, Sydney Mines; J. R. Lithgow and Wm. Lithgow, Glace Bay Mining Co., Halifax; Dr. E. Gilpin, Jr., Inspector of Mines, Halifax; J. M. Reid, Oxford Gold Mines, Musquodoboit; C. E. Willis, Halifax; G. J. Partington, Whiteburn; Howard Clarke, *The Critic*, Halifax; B. C. Wilson, Waverley; J. H. Austen, Halifax; F. Taylor, Lowell, Mass; Capt. George MacDuff, Waverley; T. R. Gue, Halifax; G. E. Francklyn, General Mining Association, Halifax; W. H. Huggins, Halifax, and H. M. Wylde, Secretary.

The Secretary read the minutes of the previous meeting, which were confirmed. The rules of the Society being suspended the following were duly elected to membership:—

NEW MEMBERS.

Mr. W. R. Thomas, Montague Mines, proposed by Capt. MacDuff, seconded by Mr. T. R. Gue; John S. Kennedy, Ferrona,

N.S., proposed by Mr. Wm. Smaill, seconded by Mr. H. M. Wylde. Associate Members—Mr. James Purvis, Cape Breton, and Mr. Geoffrey Morrow, Halifax, proposed by Mr. R. G. Leckie, seconded by Mr. Charles Archibald.

### THE MONTREAL CONVENTION.

THE SECRETARY read correspondence from Mr. B. T. A. Bell, Secretary, General Mining Association of the Province of Quebec, with reference to the International Mining Convention and meeting of the American Institute of Mining Engineers, to be held under the auspices of that body in Montreal during the week commencing 21st February, 1893.

THE PRESIDENT—Mr. C. Fergie, M. E., is preparing a paper describing the methods of mining at the Drummond Colliery; also Mr. B. C. Wilson, on the subject of leasing gold properties in Nova Scotia.

MR. JOHN E. HARDMAN — Has it been determined whether we shall attend this Convention officially or only as individuals, in other words, is the Mining Society going to send delegates to represent the Society, or are we going simply as individuals?

THE SECRETARY—This question has been considered by the Council and referred by it to this regular meeting.

MR. T. R. GUE—I believe that nearly every member intends going to Montreal, and I suggest that perhaps this Society should have a special meeting there. We could have a better meeting in Montreal at that time than we could have here, and I am strongly in favor of a special session of this Society during the Convention. If the meeting is well attended we may conclude to dispense with the next Quarterly General Meeting. I, personally, would like to go very much, and most all of the members have expressed their willingness to attend on that occasion.

MR. JOHN E. HARDMAN—Such a meeting as proposed by Mr. Gue would come under the third paragraph of the fifth

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section of the By-Laws. It could very easily be convened as a special meeting.

On motion it was voted to hold a special meeting of the Society in Montreal during the third week in February.

THE PRESIDENT said he had no doubt that the papers which would be prepared by the members of the Society would be of a character which would reflect credit not only upon the members, but also upon the Society.

DR. E. GILPIN—Would papers be read at the meeting of the Society or before the Convention?

THE SECRETARY—The Convention?

The following subjects on legislation in Nova Scotia were allocated for papers and discussion at the Convention.

- (a) That portion of the Mines and Minerals Act relating to gold, by Messrs. Stuart, Wilson and Hardman.
- (b) That portion of the Act relating to mines other than gold, by Messrs. C. Archibald and J. R. Lithgow.
- (c) The Mines Regulation Act, by Messrs. R. G. Leckie, R. H. Brown and H. S. Poole.

MR. R. G. LECKIE, referring to the suggestion contained in Mr. Bell's letter, that an excursion might be made during the Convention to Nova Scotia, said he thought the time of the year most unfavorable. It was the very worst period to visit the province and to examine its varied and excellent resources. He therefore moved: "That while acknowledging with pleasure the interest entertained by the General Mining Association of the Province of Quebec in the mining industries of this Province, and also expressing our most cordial desire to entertain the American Institute of Mining Engineers in Nova Scotia at a suitable and convenient season of the year, be it resolved: That in the opinion of the members of this Society the month of February would be a most unfavorable season to view the varied resources of this Province, and also that the difficulties and uncertainties of travel are great at that period of the year: Further, that the representatives of this Society to the Montreal Convention be and are hereby requested to consult with the officials of

the American Institute of Mining Engineers with a view to holding an autumn meeting here next year (1893)."

MR. JOHN E. HARDMAN, in seconding the resolution, said he could not add anything to what Mr. Leckie had said. At that season of the year we would not be likely to get representative mining men and capitalists to visit the Province, particularly after a protracted session in Montreal.

DR. GILPIN said he had had something to do with the autumn part of the last excursion in 1885 of the American Institute to Cape Breton. He remembered two stormy days when they had the greatest difficulty in preventing the excursionists from taking the next train home. He thought the Institute should visit Nova Scotia at a time of the year not later than the middle of September.

The resolution carried.

The Secretary was instructed to send a copy of the resolution to Mr. Bell and also to Dr. Raymond.

THE PRESIDENT invited discussion on the papers read at previous meetings.

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DISCUSSION ON MR. POOLE'S PAPER, "NEW EXPLOSIVES FOR COAL GETTING IN NOVA SCOTIA."

MR. T. R. GUE—I am preparing a paper for a future meeting fully criticising Mr. Poole's paper.

DR. E. GILPIN—The Explosives Committee is to meet again and prepare a final report. Parties who had tendered one explosive claimed that they had since introduced a slight improvement. We have a small supply of ammonite. Perhaps Mr. Brown could tell us how he succeeds with this explosive at his mine.

MR. R. H. BROWN—We tried ammonite for a short time, but our men were prejudiced against it and would not give it a fair trial. We fired a few shots and it acted the same as roburite. It seemed to blow out two or three cubic feet and would not

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DR. E. GILPIN—I do not think any of the new explosives introduced on the continent are better. They have some new explosives in France and Germany which I suppose we can not get here. So far as I know the roburite and other powders have worked fairly well. I believe that there were one or two cases of sparking—I think one in the Acadia Company—but as far as I can see in the literature on the subject I do not see anything better. The question which I think is important before the Commission, although it is a little on one side, is that in regard to detonators. I see they have been using the compressed detonator, which seems to be safer in its action.

THE PRESIDENT — Broadly speaking, you are of the opinion that the so-called flameless explosives tried in Nova Scotia are much safer than common powder for work in mines where gas is produced?

DR. GILPIN—There is no question about that.

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DISCUSSION ON MR. HARDMAN'S PAPER, "RECENT GOLD MILLING PRACTICE IN NOVA SCOTIA."

THE PRESIDENT called on Capt. G. MacDuff for some remarks on Mr. Hardman's paper.

CAPT. MACDUFF—I think the paper a very good one, and I do not see how it could be improved on. The only point I can question is the extremely low costs given.

MR. JOHN E. HARDMAN—I came here cocked and primed with explosives, one pocket full of dynamite and the other full of roburite, and with seven-fold exploders in my vest pocket, prepared to defend my paper, but as no criticism is forthcoming I fear the ammunition will have to be thrown away. Since I wrote that paper we have had considerable experience in the "Waverley Mill." In regard to costs, the cost of running the Oldham Mill was very low because water power was used, but there will not be so very much more difference in a steam mill.

The percentage of gold recovered was just as favorable running the Waverley Mill at about 100 drops per minute, as in the Oldham Mill which ran from 85 to 88 per minute. I expected this particular point would be criticised by members present. We still continue to use the same form of mortar, and recover 92 per cent. of all the gold obtained inside the mortar.

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MOTION TO APPOINT AN OFFICIAL TO REPRESENT  
NOVA SCOTIA AT THE MONTREAL CONVENTION.

It was moved by Mr. J. E. Hardman, and seconded by Mr. Charles Archibald, as follows: "In view of the importance of the February meeting at Montreal in the matter of legislation affecting mines, this Society deems it wise and expedient that the Provincial Government should be represented at that meeting; therefore be it resolved that the Secretary is hereby instructed to communicate with the Honorable Commissioner of Public Works and Mines, and to request, on behalf of the Society, that Dr. Gilpin be appointed the official representative of the Province at that meeting."

The said motion upon being put was passed unanimously.

The meeting then adjourned to meet at 2.30 p.m.

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AFTERNOON SESSION.

The Society met at 2.30. Papers on "Late Modification of Coal Mining in Nova Scotia," were read by Mr. Charles Archibald, Manager Gowrie Coal Mining Company, Cow Bay, C.B.; Mr. James Baird, Manager Canada Coal and Railway Company, Joggins' Mines, N.S., and by Mr. H. S. Poole, for J. G. Rutherford, Acadia Coal Company, Stellarton, N.S., and for Mr. Maxwell, also of the Acadia Coal Company.

On motion a vote of thanks was passed to each of the gentlemen who had contributed a paper.

After discussion it was resolved that these papers, descriptive of late Nova Scotia practice in coal mining, should be con-

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A. Blake, Nev  
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solidated and presented as a joint paper at the special meeting of the Society to be held in Montreal during the session of the International Mining Convention.

There was an informal meeting of the Society at the Halifax Hotel in the evening, at which mining matters were freely discussed.

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## SPECIAL MEETING.

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### MONTREAL.

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WEDNESDAY, 22ND FEBRUARY, 1893.

A special meeting of the Society was held in connection with the proceedings of the International Mining Convention, held under the auspices of the General Mining Association of the Province of Quebec, at Montreal, on Wednesday, 22nd February, 1893. The meeting was held, by courtesy of the Governors of the University, in Lecture Room C of the new Physics Building, McGill University. The proceedings opened at three o'clock, when Mr. H. S. Poole, President of the Society, took the chair.

There were present: Charles Archibald, Cow Bay, C.B.; A. Blue, Director of Mines, Toronto; B. T. A. Bell, Ottawa; Dr. Robert Bell, Ottawa; Jas. T. Burchall, Sydney, C.B.; Theo. A. Blake, New Haven, Conn.; Ian Cameron, Sudbury; Dr. David T. Day, Washington; Hon. W. S. Fielding, Halifax; G. E. Francklyn, Halifax; Graham Fraser, New Glasgow; E. R. Faribault, Ottawa; T. R. Gue, Halifax; John E. Hardman, Oldham; John S. Kennedy, Ferrona; R. G. Leckie, Londonderry; W. Hamilton Merritt, Toronto; R. H. Brown, Sydney Mines; R. G. E. Leckie, Torbrook; W. B. Moore, New Glasgow; J. Burley Smith, Glen Almond, Que.; John J. Penhale, Black Lake, Que.; G. R. Mickle, Sudbury; George MacDuff, Waverley; H. S. Poole, Stellarton; D. W. Robb, Amherst; Wm. Smaill, Londonderry; E.

Sjostedt, New Glasgow; Alfred Woodhouse, Montague; H. M. Wylde, Halifax, Secretary. The following papers were presented by members of the Society at this meeting and at the sessions of the United Convention on the following day:

NOTES ON THE ORES AND THE BLAST-FURNACE  
PLANT OF THE PICTOU CHARCOAL IRON CO.,  
LTD., BRIDGEVILLE, N.S.

—  
MR. E. SJOSTEDT, 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, from 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

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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 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 casting 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 cubic ft. of air per minute (engine measure), up to 750° to 800° F.

The boilers are four in number (30 ft. x 36 ft.), made of best five-sixteenth 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

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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 ( $7\frac{1}{2}$  in. s. c. x  $4\frac{1}{2}$  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 1,200 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 feet above, which showed up a large body of ore, in some places 18 feet 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 three to four 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° 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:

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	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
Phosphorus.....	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 II.), to the chute 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 guage 3 x 3 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 (three miles), to our furnace, costing us about 85 cts. per gross ton delivered. It contains about 94.0% carbonate of lime, 2.05% 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
Phosphorus .....	.008
Undetermined loss.....	.372

100.000

DISCUSSION.

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 shapes in 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.

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## ELECTRICAL COAL MINING.

—  
MR. JAS. T. BURCHALL, SYDNEY, C. B.  
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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 practicality of cutting coal by machinery is an established fact.

Anyone 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 com-

plete control of the operator, can be guided so as to perform the work in coal and avoid contact 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

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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  $7\frac{1}{2}$  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  $7\frac{1}{2}$  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 plants in the United States for a comparison, I secured the following reply: "We consider electric power the strongest, steadiest, most economical 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

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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 abstract 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 everyone 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 utilised 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. 0 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 anyone 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 argument 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.

## DISCUSSION.

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 anyone 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  $7\frac{1}{2}$  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  $7\frac{1}{2}$  h.p. motor is not in reality a larger motor, and does it not absorb more than the  $23\frac{1}{2}$  h.p. rather than indicated by the statement that it is simply a  $7\frac{1}{2}$  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  $7\frac{1}{2}$  h.p. motor he referred to was one Mr. Lloyd had used.

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 under-cutting 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  $7\frac{1}{2}$  h.p. motor consumed 23 h.p. from the generator was really a point in favor of the motor; which although rated at  $7\frac{1}{2}$  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

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them broadside 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 under-cut, 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-Sergeant 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 the Transactions, in other words, valuable literature on the mining practice and mineral resources of the country. By the 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.

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## NOTES ON THE LEGISLATION AFFECTING THE WORKING AND REGULATION OF MINES IN NOVA SCOTIA.

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BY MR. H. S. POOLE, STELLARTON.  
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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.

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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 favor of life. It began by including all openings for mining purposes as subject to its provisions and then in provisoes made certain ex-



emptions. 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 penalties 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 another 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 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 facili-

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\* Chap. v., 1881.



ties 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 step 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 4 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, bookkeepers, 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 anyone 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.

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.



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

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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 backbone enough to refuse to fire it when the conditions are not favorable. 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 anyone 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 labor 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 labor 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 favor 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

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

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 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.

These incongruities, it is believed, would be reduced, if not entirely removed, were it to become the practice for all mining legislation to emanate from the Department of Mines.

Certainly an Act of this sort should not nominally require more of mine managers and workmen than it is intended shall actually be done and carried out. There should be no clauses retained which are openly violated and winked at. It will be remembered a couple of years ago the general rule prohibiting the unramming of shots was amended, at the instigation of workingmen, because the practice was so common even in face of the regulation, and although it was acknowledged the practice was attended with some danger. Then so far as possible ambiguities should be avoided, and if allowances are to be made they should be legalized in provisoes.



## DISCUSSION.

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 has 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 workingmen 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 workingmen 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 diploma 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 exception 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 to-day, 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.

BY CHAS. FERGIE, WESTVILLE.

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  $2\frac{3}{4}$  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 ft. 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 three 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  $1\frac{5}{8}$  in. diameter, and also steel; the bearings are inside; the guage is 2 ft.  $8\frac{1}{2}$  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  $\frac{7}{8}$  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 by 3 in. wrought iron flanged pipes to a point 3,700 ft. on the slope. The latest pipes 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 con-

denser; 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 guage of seven-tenth in. A steam jet is provided in case of accident to fan, and is capable of producing 25,000 cubic 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 bankhead 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 bankhead 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 (see plate), 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, one 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 ft. 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 resorted 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 preceeding 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 occurrence 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.

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## MODIFICATION OF WORKING COAL LATELY INTRODUCED IN NOVA SCOTIA.

## I. PICTOU COUNTY.

BY MR. J. G. RUTHERFORD, B.A., M.E., STELLARTON.

The method of getting coal by longwall is not entirely new in Pictou County. Some old crop workings on the deep seam were operated on this system previous to the year 1828, and in 1860 a small area of the oil-coal or Stellar seam was worked in a similar manner by the late Mr. Henry Poole; but the practice has almost generally obtained of working by the bord and pillar method, by which from 30 to 40 per cent. of the seam is got on first workings. In some noteworthy cases this forewinning has been rapidly and successfully followed by pillar drawings, or as termed in the north of England, "working the broken;" in others, this inherent principle of working by bord and pillar has been lost sight of or voluntarily ignored.

The main or highest workable seam—some 30 or 40 feet thick—of the Albion series, has been extensively worked on the latter system, and much of the coal left primarily in pillars has been subsequently extracted. To the dip, however, a large area of workings exist in which no pillars have been robbed. The deep or cage pit seam which underlies the main, separated by about 156 feet of measures principally brown shale, has also to a considerable extent been worked on the same system, and a small proportion of the rise pillars were successfully withdrawn, but evidence of a gob fire existing having been observed, the district was speedily abandoned and built off from the rest of the mine.

When the workings on these two valuable seams were temporarily rendered unproductive by the explosion in the Foord pit in 1880, and the subsequent firing of both seams, attention was at once directed to the immediately underlying seams—

hitherto unwrought—viz: the third and McGregor. Crop openings were made and the work laid out on the bord and pillar method. The main slope of the third seam is now down a distance of 1,880 feet from the entrance, and the vertical depth of the lowest level is 700 and odd feet. From this point a pair of stone drifts or tunnels were set away with a slight rise across the measures, which would enter the overlying deep seam at a point below the lowest of the old workings of the Cage pit. After passing through very hard strata the seam was penetrated at a distance of 219 feet and presented the following section taken vertically to the place of stratification.

Thill or pavement—Brown shale.

	Feet.	Inches.
COAL (good).....	3	10
Coarse coal and shale .....	8	7
Shale with ironstone nodules .....		11
Coarse coal.....	3	10
COAL (good).....	13	4
Coarse coal with ironstone bands ...	3	6
COAL (good).....	4	3

For the purposes of this paper, the names applied locally to the different divisions of the seam will be adopted, and hereafter the main or 13 ft. 4 in. portion will be known as the deep seam, and the highest or 4 ft. 3 in. part as the Little or 4 ft. seam.

The deep seam having been worked to some extent a few years ago, its character is pretty well known; but with the exception of a small pair of dip slants for drainage purposes, the Little seam, in which the recently adopted longwall work is carried on, had not hitherto been worked. It may be well then to describe it. As shewn in the section it is 4 ft. 3 in. thick, and is a clean, bright coal from roof to pavement. There is a variable amount, generally 12 to 14 inches, of excellent cannel next the floor. Proceeding in an easterly direction the cannel is gradually replaced by coal similar to the upper part of the seam, but more lustrous and of a freer nature. The cleat is well defined and at right angles to the bedding plane. It bears about 10



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degrees east of full dip; the latter being N. 45° E., at an angle of 20° to 21°, increasing in a westerly direction and growing lighter towards the east. The seam is traversed by a system of parallel joints, bearing about 29 degrees east of the dip and seldom further apart than a yard, frequently as close together as six inches. These joints do not extend upwards beyond the coal, but are observed in the pavement and underlying Deep seam. They hade with the dip of the seam at a light angle. While lypes or backs are frequent in the Deep seam, running in every direction, they are seldom met with in the Little seam.

*Method of Working*—When the Deep seam was reached a main or haulage level 9 ft. by 8 ft. high was turned away right and left or in an easterly and westerly direction. Rise headings were put up at intervals and connected in order to form a return airway, and a stapple pit some 16 feet deep was sunk to the back or return stone drift. Tunnels or drifts were driven into the Little seam also from the same level, and additional levels set away in that seam right and left parallel to those in the Deep seam. These form the intake airways of the mine. Beyond driving the exploratory levels on the west side, nothing further has been done; so that this description of the mode of working refers to the east side only—although in the course of time, it may be adopted throughout the mine. Furthermore, it must be borne in mind that so far as the work has progressed, it has been conducted on a limited and purely experimental scale.

Counterbalance planes, 400 ft. apart, are driven to the full rise from the main haulage level in the Deep seam, and as near to the old sealed workings of the Cage pit as is considered prudent, the proximity of these old workings being proved by bore holes. From these planes, bords 12 ft. wide and separated by pillars of coal 47 ft. thick are turned away to the left, and when they have been driven in a distance of 66 ft., drifts or tunnels 6 ft. square, are started from the low side of each bord and nearly at right angles to them and driven on a rise of from 1½ to 2 inches per yard until the Little seam is reached. Connection is then made in that seam between the several tunnels or drifts,

and the longwall face thus established. Timber chocks 9 ft. long by 4 ft. wide are built on each side of the tunnel where it enters the Little seam, and booms of large dimensions stretched across, in order to protect it when the weight comes on. The length of wall or face assigned to each set of men, is governed by the dip and thickness of pillar left between the bords in the Deep seam. It is now about 51 feet. As the face advances, it becomes necessary to afford support for the roof, in order to keep the roadways open for the transport of the coal, and for this purpose, principally, the roof is blasted down or as locally termed "brushed." The roof so far as it has been penetrated consists of fireclay of varying degrees of hardness, that immediately overlying the coal containing much ironstone in nodules. At from 2 feet 6 inches to 3 feet from the top of the seam, there is a parting of soft black fireclay, and the first brushing generally extends up to this. The amount of stone brought down is not more than sufficient to build a pack wall—from 9 to 12 feet wide—on the low side of the roadway, consequently timber chocks 4 feet square and not farther apart than 2 feet are built along the high side and filled in with any loose debris there may be lying about. The width of the roadway or gob road properly speaking, is about 9 feet—that is between the packwall and the chocks, and the space between the chocks and the packwall to the rise locally known as the "cundie"—(Scotch for conduit)—is therefore not greater than 29 or 30 feet. Props are set at variable distances apart along the face to secure the men, but in no instance has the roof fallen nearer to the face than 20 feet. Occasionally falls of roof up to the black fireclay parting take place back in the cundie but they are of no moment. The lower end of the face or wall is kept slightly in advance of the upper part, as shewn in Fig. 1 (see plate), and thus affords full advantage to be taken of the direction of the cleat and joints. The line of fracture of the roof runs slightly to the west of full dip.

As the face advances, the heaving of the pavement is soon noticeable, and the back props, many of which are left in, are readily broken. The general effect produced by the extraction

of the coal, appears, so far as observed, to partake of the character of a creep, inasmuch as there is a gradual subsidence of the roof, coupled with an upheaval of the floor, equally as regular in movement. Packwalls and chocks at the outbye end of the work, which, six months ago, were over 4 feet thick are now compressed into a space of less than one foot. This coming together of the roof and pavement necessitates recourse to more brushing, and at the present time the outer end of the gob roads is almost entirely up in the solid roof.

While the operation of drifting into the Little seam is in progress, the bords in the deep seam continue to advance, and the lead thus obtained is held until the limit or divisional barrier between the balances is reached. The ratio of advance as regards the bords to the longwall is as 3 to 1, and the output per man employed is very slightly in favor of the bords.

Each wall or face is let to a set of men, generally four in number, and they are paid a fixed price per ton for all coal sent to bank which is practically the whole seam, for there is no loss or waste in working. The brushing is paid for by the lineal yard, and for these two considerations the men undertake to do everything in connection with the work, excepting the firing of shots, which is done in compliance with the law by the deputy overman. The quantity of explosive used compared with the consumption in the bord and pillar work generally, is about one third. The undercutting or holing is done in the bottom part of the seam, as there are two thin bands of hard ironstone separated by an inch or two of coal, immediately under the seam. The holing extends forward from three feet six inches to four feet, and as the jud is formed, sprags are used to support it until the undercutting is completed, when they are withdrawn and the coal brought down. Instances have occurred where the greater part of a shift has been employed in undercutting the whole length of the face, and on returning on the following day the jud has been found to have come bodily away and broken up into large masses. The opportunity of learning the proportion of round or lump coal produced by the longwall, for comparison

with the quantity from the bord and pillar work has not yet occurred, because the output from the Little seam being small, no care has been taken to keep it separate from the produce of the other parts of the mine.

The ventilation is simple. The intake air enters by the main stone drift and passes at once into the level in the Little seam. It splits at the inbye heading in that seam, and while sufficient is taken directly to the longwall faces, the bulk is made to traverse the workings in the Deep seam. At the highest point in the longwall working, a small pit is put down on the bord below, and the return air meets at this point, the return from the Deep seam, and together they travel down the balance, along a level to the stapple pit and so into the back stone drift and thence by the return airways in the third seam to the fan shaft or upcast.

Of course the intention is, when the longwall face shall have reached the barrier proposed to be left next the inbye balance, to withdraw the underlying pillars in the Deep seam, but with what success this may be accomplished is as yet a matter of conjecture.

When the circumstances are favorable—and in the case just described this appears to be so—the advantages to be derived by working on the longwall method are too well known to need comment here.

With respect to the drawings accompanying this description, it may be well to add a word or two in explanation. Fig. 1 is intended to represent the longwall work in the Little seam, and the underlying workings in the Deep seam are shown by white dotted lines. The balance on the right hand is the one at present in operation, and the one further to the east or left, is intended to represent the process of developing a new longwall face. It will be apparent that by this system of working, the counter-balance planes in the Deep seam carry all the coal given both by the longwall and the bords. Moreover, another important advantage which the method affords is gained by working in panels or districts separated by barriers of coal, for in the event of a



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gob fire, and such are not unknown, the facility with which a district can be speedily isolated is readily apparent.

It will be observed that the three lower bords of the left hand balance have been connected with the Little seam by means of the drifts. The two lowest of these drifts have in turn made a connection with the Little seam, while communication between the second and third headings is not yet completed. The fourth has nearly effected an entrance into the Little seam, and the fifth is only about half way through.

Fig. 2 is a partial section on the line A, B, and shews the method of connecting the two seams by the drifts, through one of which a box of coal is being brought to be placed on the balance cage in the lower seam. The packwalls of stone are shewn on the dip side, and the timber chocks to the rise.

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## II. ACADIA COLLIERY.

BY MR. JAMES MAXWELL, Manager of the Acadia Pit,  
Acadia Coal Company, Westville, N.S.

The seam dips at an angle of  $27^{\circ}$  to  $30^{\circ}$ , and until the workings reached a vertical depth of 1,200 feet, the method of working was by driving back balances to the full rise 400 feet, and breaking off bords on a level course inbye for a distance of 400 feet, and then working the pillars on a nearly straight face to the full rise back to the balance.

Where greater depths were attained the method that had answered so well heretofore failed, and it mattered not how narrow the primary openings were made, the pressure soon wrecked them. A change of system became inevitable. As narrow places could not be kept open by timber, even where placed skin per skin, it was determined to try an opposite course and make the

working places wide. So far successfully, and the method adopted is to drive headings 26 feet wide to the full rise or pitch of the seam, carrying up on the intake side 2 feet from the cone a packwall with timber 5 feet wide, a space 6 feet wide is then left for a travelling way and for working a counterbalance that takes up timber. Then follows up the centre of the heading a chock pack 5 feet wide separating the travelling way from the coal chute, which is made 6 feet wide. Another similar pack 5 feet wide, forms the other side of the coal chute, and being placed 2 feet from the coal makes a return airway when the heading is being driven up.

At right angles off the chute, walls are started every 12 yards, and a pack 5 feet wide is carried on the low side 2 feet from the wall; then a space 7 feet wide serves for the track on which the tubs run to and from the working face. A continuous chocking 5 feet thick on the high side of the road leaves an open space about 17 feet wide to fall in, which it does on every advance of 5 or 6 yards. These falls return the pressure on the roads which stand fairly well for a distance of 200 feet, the length between the headings.

The thickness of coal worked in these walls is  $6\frac{1}{2}$  or 7 feet. In the roadways other two feet of bottom is taken up and the material stowed in the packs. The height of 9 feet thus obtained is generally sufficient to allow for the settlement due to the pressure. The chocks on the low side of the roadways are placed about 3 feet apart to leave space for stowage. The chocks on the high side are placed close together to prevent the gob from falling on the roadway.

The face is not in a straight line, but worked in steps, the better to prevent it being closed, which it is apt to do when the falls take place.

The shales forming the roof are very soft, and require cross timbers every 4 feet resting on the chocks.

The chock wood is taken up in schooners, long narrow bores running in a 16 inch track with a passing place in the middle of the travelling ways. The schooner at the top of the heading on

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being loaded with coal, acts as a counterbalance to take up the one below loaded with a less weight of chock wood. The coal from the faces is dumped into the chute down which it slides on iron sheets to the level below, where it is loaded with boxes carrying a ton each.

It is interesting to note that while bords 9 ft. x 7 ft. within a few weeks of being driven were reduced in size by the pressure, both on the tops and sides to such an extent that a box 4 feet square could no longer pass, places driven wide and but little higher to allow for the settlement of the strata have required but little attention to keep them open.

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### III. JOGGINS MINES, CUMBERLAND COUNTY, N.S.

—  
 BY MR. JAMES BAIRD, MACCAN, N.S.  
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The seam of coal at present worked at the Joggins colliery lies at an angle of 17 degs. with the horizon, and is opened out by a slope driven in the seam direct to the dip, a distance of 1,900 feet or 2,300 feet to the face of our present sinkings and the vertical cover at this point is about 670 feet. The seam is from 6 to 9 feet in thickness and of the following section in ascending order:—

Bench coal.....	2 feet.
Fireclay.....	1 to 3 "
Fall coal.....	3 to 4 "

There is a good hard roof, the sandstone in some places being in contact with the coal.

Up to September, 1890, this seam was worked by bord and pillar, but on taking charge of the mine at that date I altered the system to longwall pure and simple as it is termed. The fireclay band being of too soft a nature to build walls with, I was

obliged to adopt wooden butts 8 feet by 4 feet, built as shown on the accompanying sketch, and for this purpose I used mostly any size or kind of timber I could get. I found the best plan to keep our roads and faces safe was to place the butts lengthwise to the roads and not farther apart than 4 feet. As will be seen by the plan, I had a good chance to try the different methods of keeping roads and face of work. The crossroads or half angle across the dip I consider a good plan. They are rather steep for horses but work well by self-acting inclines. We drive these places 360 feet, which I am of opinion is a good length for roads straight uphill or half across, and with seven or eight working faces of 50 feet to each set of men, makes good work. The straighter the face is kept the better; no jogs or corners to take extra weight.

When the seam is 8 feet or over in height we can run our tubs with very little brushing. I might mention one point in longwall working is to have the right plant, viz:—narrow gauge and low tubs, put in at first; it is much easier to make plant for the mine than to make the mine for the plant. The roof sometimes bends quite gradually; at points it breaks heavily. We have been very fortunate in the way of breaks, never having had a butt thrust out of its place, and the roads have always kept good under the most severe strain.

The system of ventilation is simple, most of the air travelling along the different faces of work as shown on the sketch.

I also give a sketch of faults met with on our 1,900 feet level going east, which we have put through successfully with our longwall work, and I have yet to learn where the extra cost comes in compared with putting through faults when working bord and pillar.

Some writers claim that longwall pure and simple, can be worked only in thin seams lying flat or at an easy angle, with a good hard roof, free from faults, &c., while others say that any seam lying at any angle and with any kind of roof can be worked by that method. I fancy that the first miner of coal was a longwall worker, and that the first break of the roof made him alter his system, and there have been a good many men follow



him in that way. In longwall the great difficulty is to keep the face of work secure in order that men may mine and load their coal easily and in safety. The first break of the roof is looked forward to with interest as it is always a test of the butts or buildings put in to maintain the roadways, or as some claim, whether the roof is too hard or too soft for longwall work.

I may draw your attention to the fact that our present lift is being sunk on the longwall system. You will notice that we are taking all the coal out, not even leaving slope pillars, but building butts of timber on both sides, and I consider it will be, when finished, and the measures once settled down, the best part of our slope.

Generally, every few years slopes have to be retimbered, and especially where the pillars have not been left large enough, great expense is entailed in maintaining them in order, but in this case by longwall, once timbered forever timbered. Certainly I lay myself open to criticism in this assertion, but I hope to be able to defend my action.

As we must all learn by experience, and if that experience does not cost the companies we work for anything, but saves them money, then we, as managers, should be safe in experimenting.

In conclusion, I can safely say that the adoption of longwall at the Joggins has been a benefit to all concerned; the miner gets more coal with less labor. A greater quantity of timber is consumed, but the additional cost is more than offset by the other advantages.

No explosive is used by the miner in getting the coal, and only a very small quantity in brushing the main roads.

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*IV. GOWRIE COLLIERY, CAPE BRETON.*

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BY MR. CHARLES ARCHIBALD, COW BAY, C.B.  
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In responding to the request of the Council to read a brief paper on the system of working coal at the Gowrie mines, I do so feeling that it will not contain anything new or interesting to my mining friends. The intention I understand is to get opinions at this meeting on the longwall system of working. The pillar and room system has been universally adopted at the coal mines in Cape Breton, until the Gardener mine very recently changed from that system to longwall.

The MacAulay seam worked at the Gowrie mines varies in height from 4 ft. 8 in. to 5 ft. 6 in., but the usual or mean height is 5 ft. It has always been worked on the "pillar and room system." For many years the rooms were driven six yards wide and the pillars from five to seven according to circumstances.

The coal dips at an angle of  $8\frac{1}{2}^{\circ}$  clear, the crop flattening as is usual towards the basin, and for the past ten years the dip has averaged about six degrees. The method of working is as follows: Two levels, the upper or main, and the lower or water level, are driven nearly on the end of the coal with a ten yard pillar of coal between, and the rooms are turned up the hill or to the pit from the main level. The coal dips to the northward, and while the levels are about seventy degrees west of north, and correspondingly seventy degrees east of south, the rooms are all driven south. The upper level is driven ten feet wide, the roof being good and safe to allow this width, and spare roads can be laid down without the expense of widening; the lower or water level, is about eight feet in width. Cross cuts are made usually one chain apart, and slant roads take the place of cross cuts where required.

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No powder is used except on the levels and cross cuts; the coal is undercut or holed about three feet, or a pickhandle, sheared on one side of the room and brought down by steel wedges. The nature of the coal of course favors the wedging system, as there is a perfect parting at the roof, and a roof coal varying from four inches to eight inches which is separated and stowed in the roof.

For many years the rooms were driven narrow, or the ordinary width of six yards; the roadway was laid up the centre of the place and the roof coal, and when the coal was riddled the slack was stowed on each side of the roadway against the pillars. The expense and inconvenience of clearing the pillars to remove them was one of the causes that induced the change of working, and about twenty years ago the plan of driving the rooms ten yards wide and leaving the pillars the old width was adopted, and has continued successfully ever since. By this plan the roadways instead of running up the middle of the room, were laid about three feet from the side of the pillars; the centre of the room was well timbered, and the roof coal and any refuse was thrown or stored in the centre of the place, thus leaving the face of the pillars clean. The pillars were removed to great advantage and with comparatively little expense; the rooms were driven to a counter level, and after leaving a pillar sufficiently strong to protect the roadway or counter level, the pillars were brought back; the rails being taken up on the retreat and the top allowed to come in. Besides the advantage gained by cheapening and facilitating the withdrawal of the pillars, the wide room, or, as it might be termed, the semi-longwall system, enabled the getting of more coal by the same number of men than if they worked in narrow rooms. Another felt advantage was that a larger percentage of coal was drawn for the same amount of narrow work before the removal of pillars. By narrow work I mean levels and cross cuts, as for example roughly, the rooms being ten yards wide and the pillars six, we get ten-sixths or one and two-thirds as against one, or two-thirds more. The removing of such a large percentage by rooms may not

appear to some a pecuniary advantage, as miners are generally paid at a less rate per ton for removing pillars, but my experience in working the MacAulay seam has proved that the wide room system beside other advantages has been a pecuniary success.

I am well aware that the working of the wide rooms successfully depends upon the height of the seam, and more particularly on the nature of the roof; and in a mine where close timbering was required, it would not pay, and in many cases would be impracticable.

The roads laid up each side of the room are kept about three feet from the pillar; the space allowed for the roadway is about six feet from the side of the pillar; a row of props, five inches or more in the small end, are set under cap pieces and extend from roadway to roadway. Usually only four or five are used in each row, placed about four to five feet apart. These rows of props are put about every five feet. If necessary, of course more timber is used.

In breaking off rooms, they are started narrow from the level pillar, say six yards, and gradually widened until they reach ten yards; the widening is done on one side, thus leaving one straight side from the level to face. When the rooms are started, two roads, one alongside of each pillar, are used, but when the room is advanced some distance, to economize in the use of rails, a sweep is put in and at that point there is only a single road to the level.

The coal is filled into boxes, containing from twenty-five hundred to thirty-five hundred pounds each, and the difference depends upon how the miner fills and heaps his tubs.

I trust that this brief description, together with the rough sketch, will enable everyone present to understand the very simple method of the wide room system adopted at the Gowrie mines.



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TRANSACTIONS OF THE MINING SOCIETY OF NOVA SCOTIA

VOL. I., PART IV.

Plate VII.—Illustrating Mr. J. G. Rutherford's Paper on the "Modification of Working Coal lately introduced into Nova Scotia."

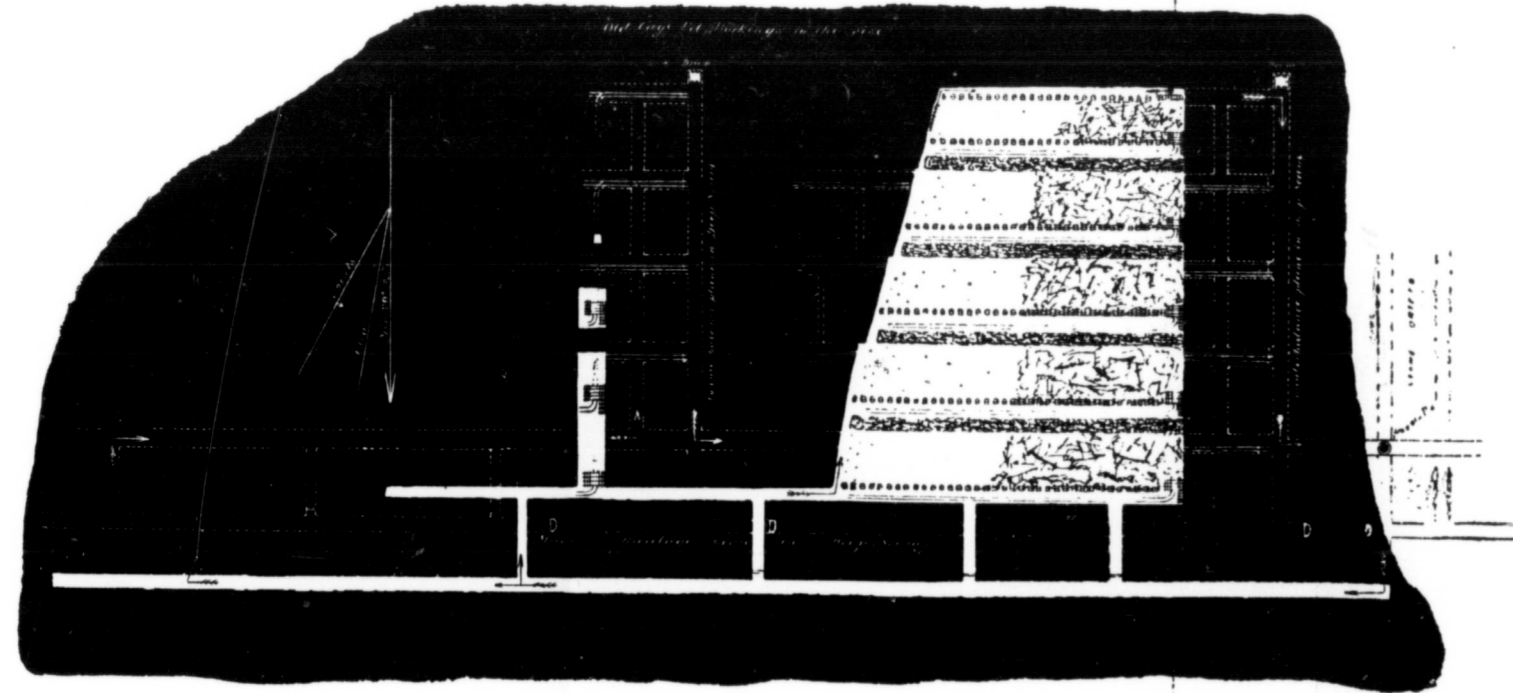


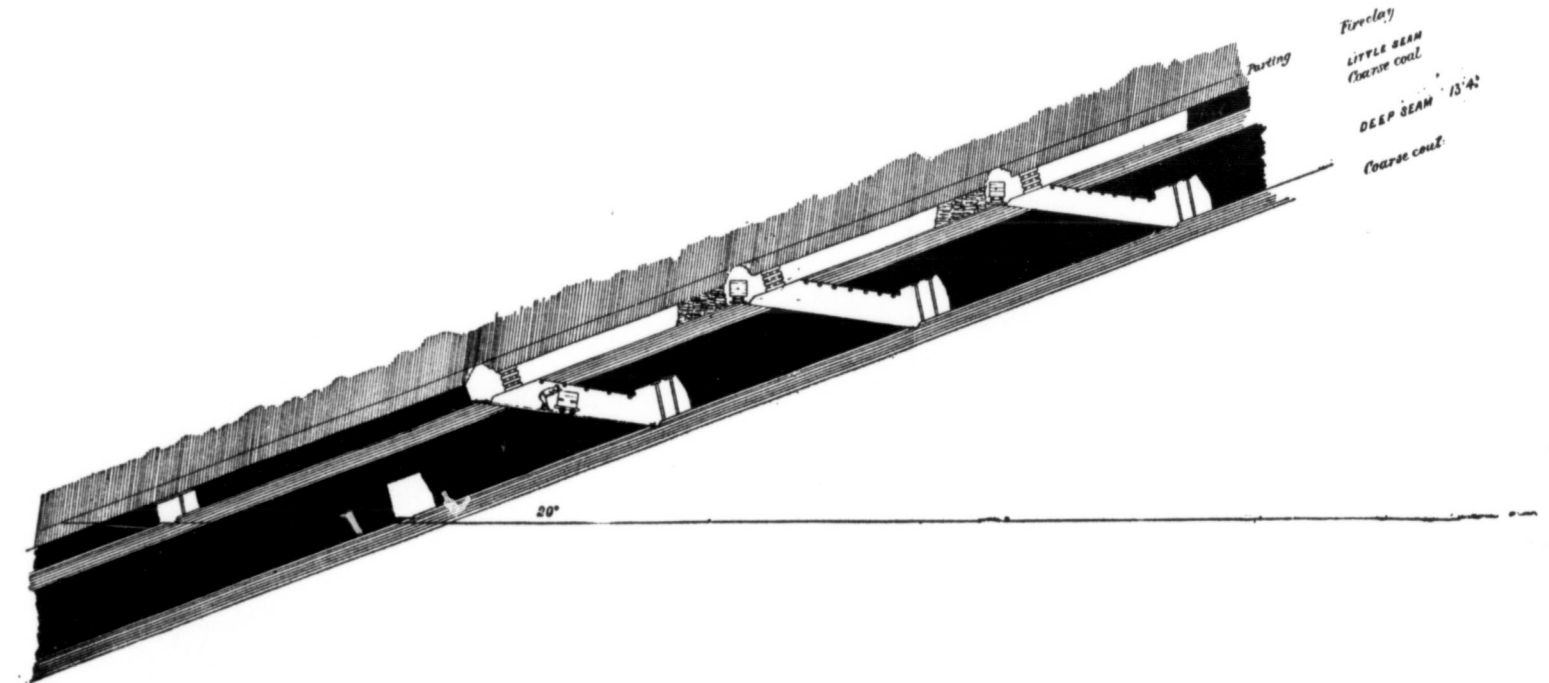
FIG. 1.—PLAN OF LONG WALL LITTLE SEAM, ALBION MINES, PICTOU CO.

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FIG. 2.—PARTIAL SECTION ON LINE A.B.



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Plate I.—Illustrating Mr. E. A. Sjostedt's Paper, "Notes on the Ores and Blast Furnace Plant of the Pictou Charcoal Iron Co. Ltd."

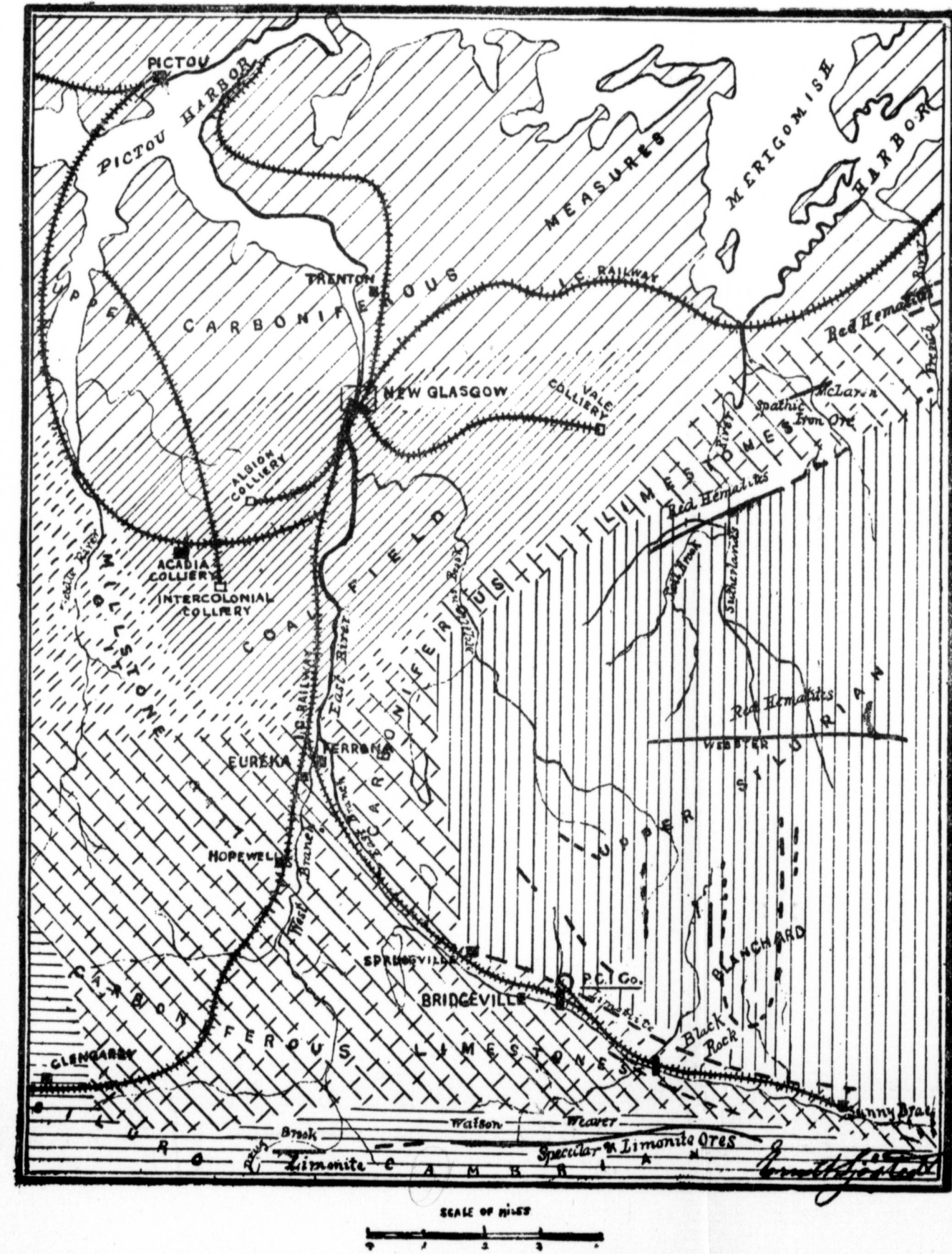


Plate II.—Illustrating Mr. E. A. Sjostedt's Paper, "Notes on the Ores and Blast Furnace Plant of the Pictou Charcoal Iron Co. Ltd."

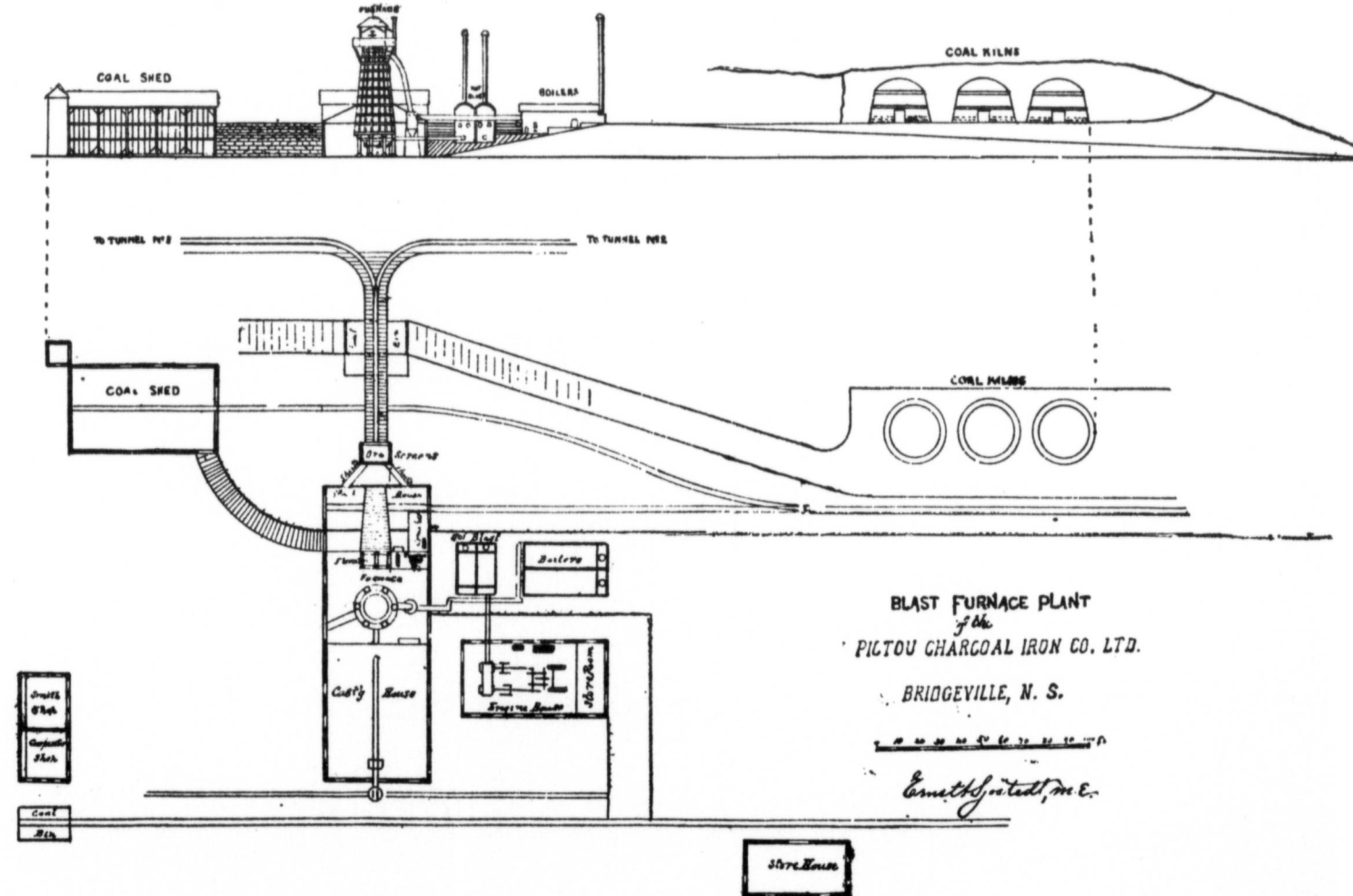


Plate III.—Illustrating Mr. E. A. Sjostedt's Paper, "Notes on the Ores and Blast Furnace Plant of the Pictou Charcoal Iron Co. Ltd."

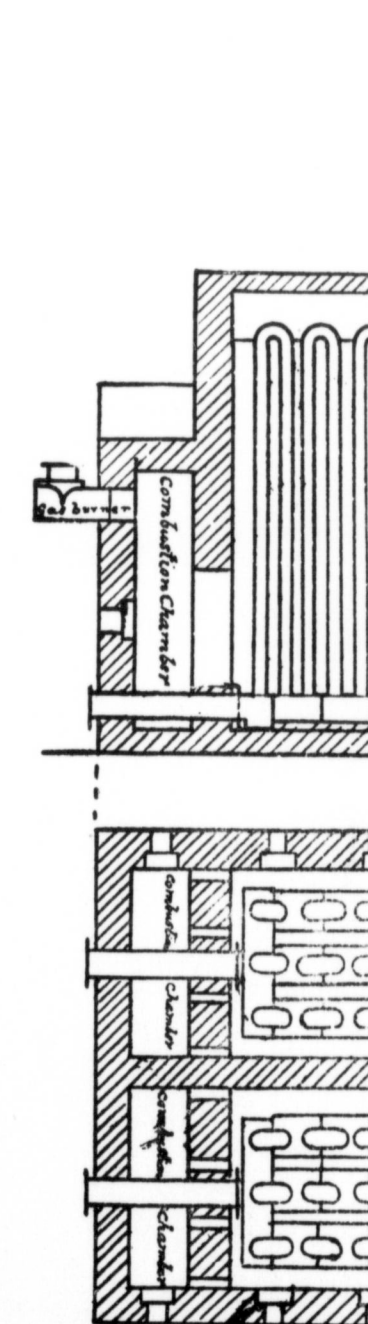


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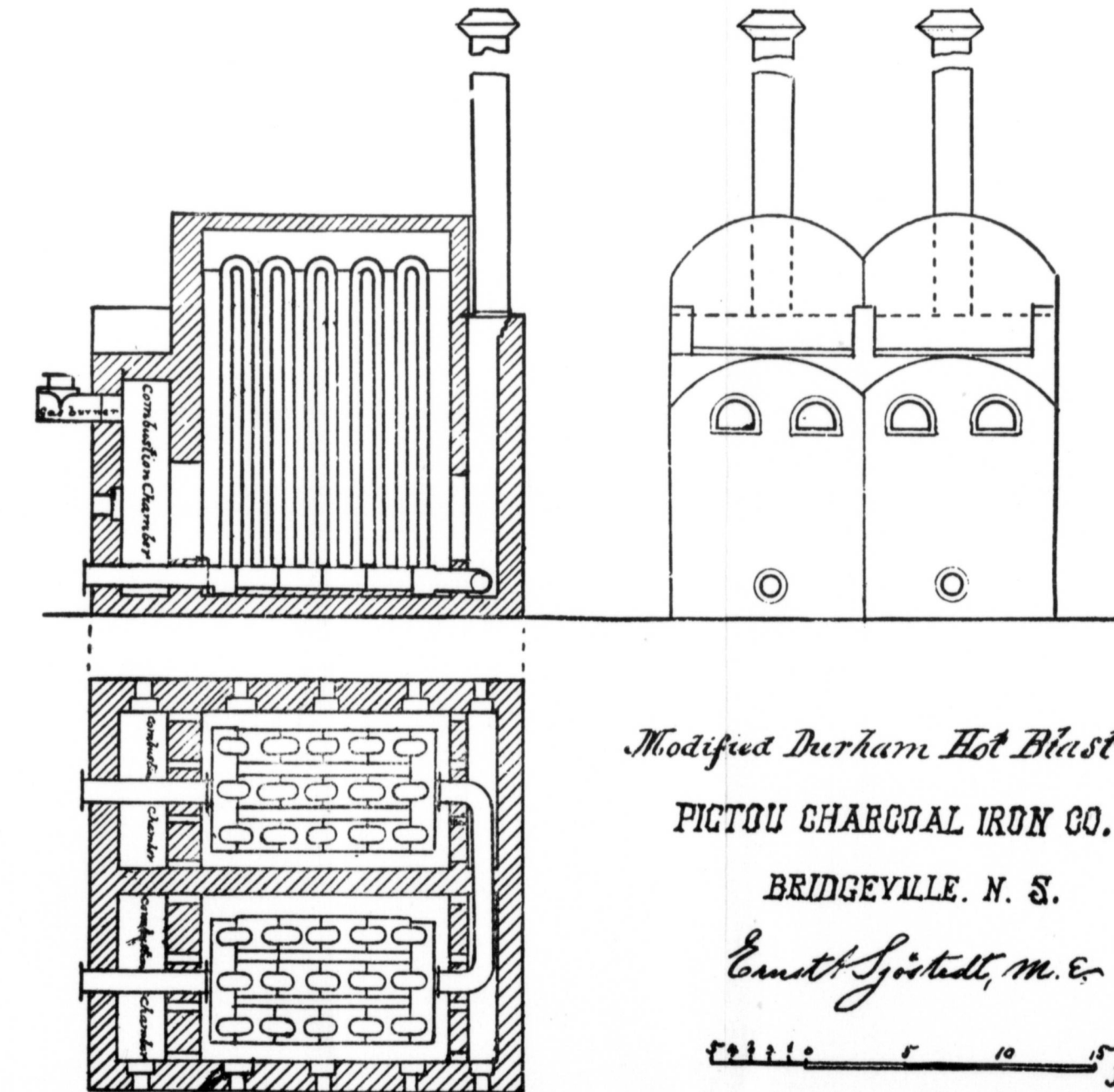
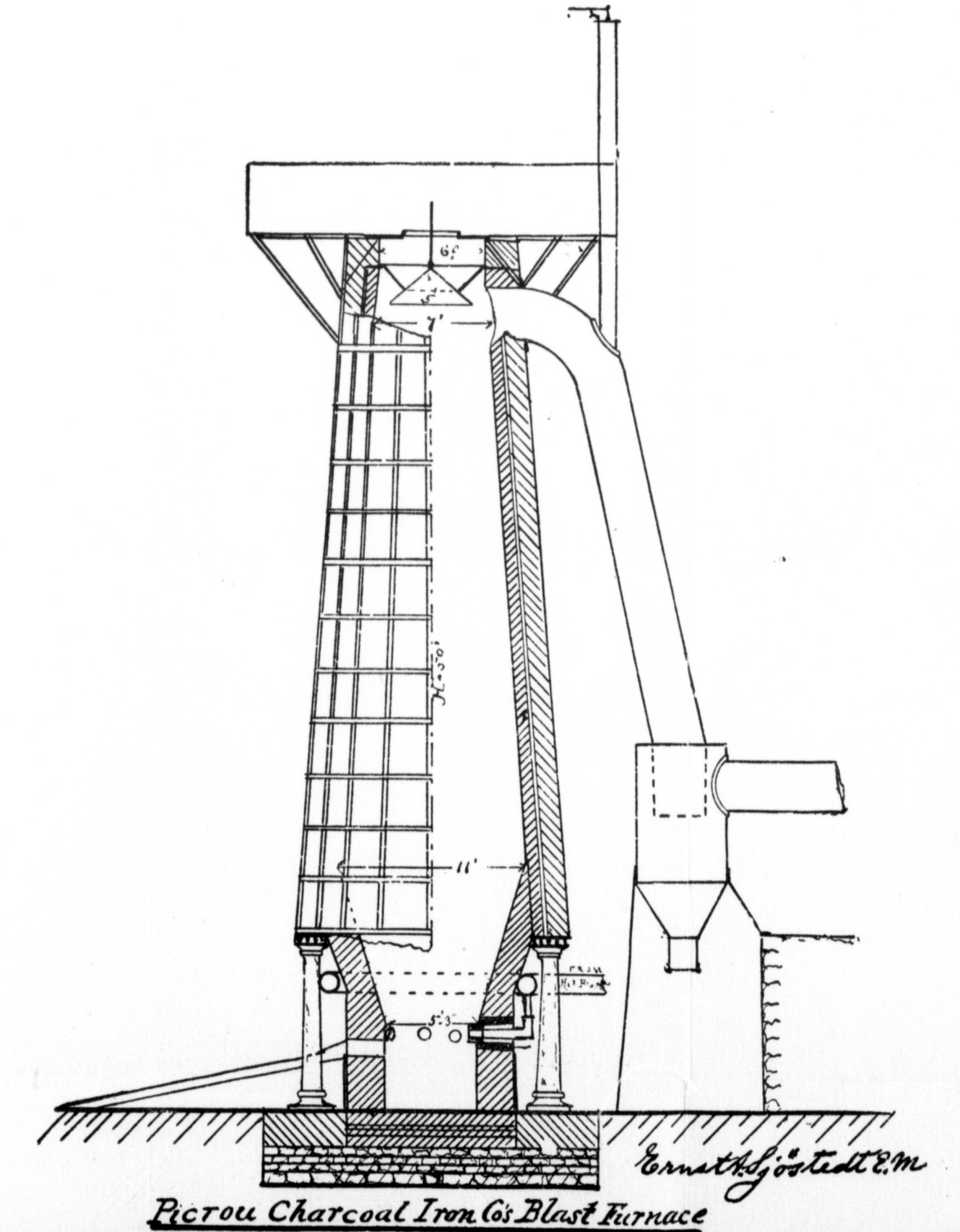


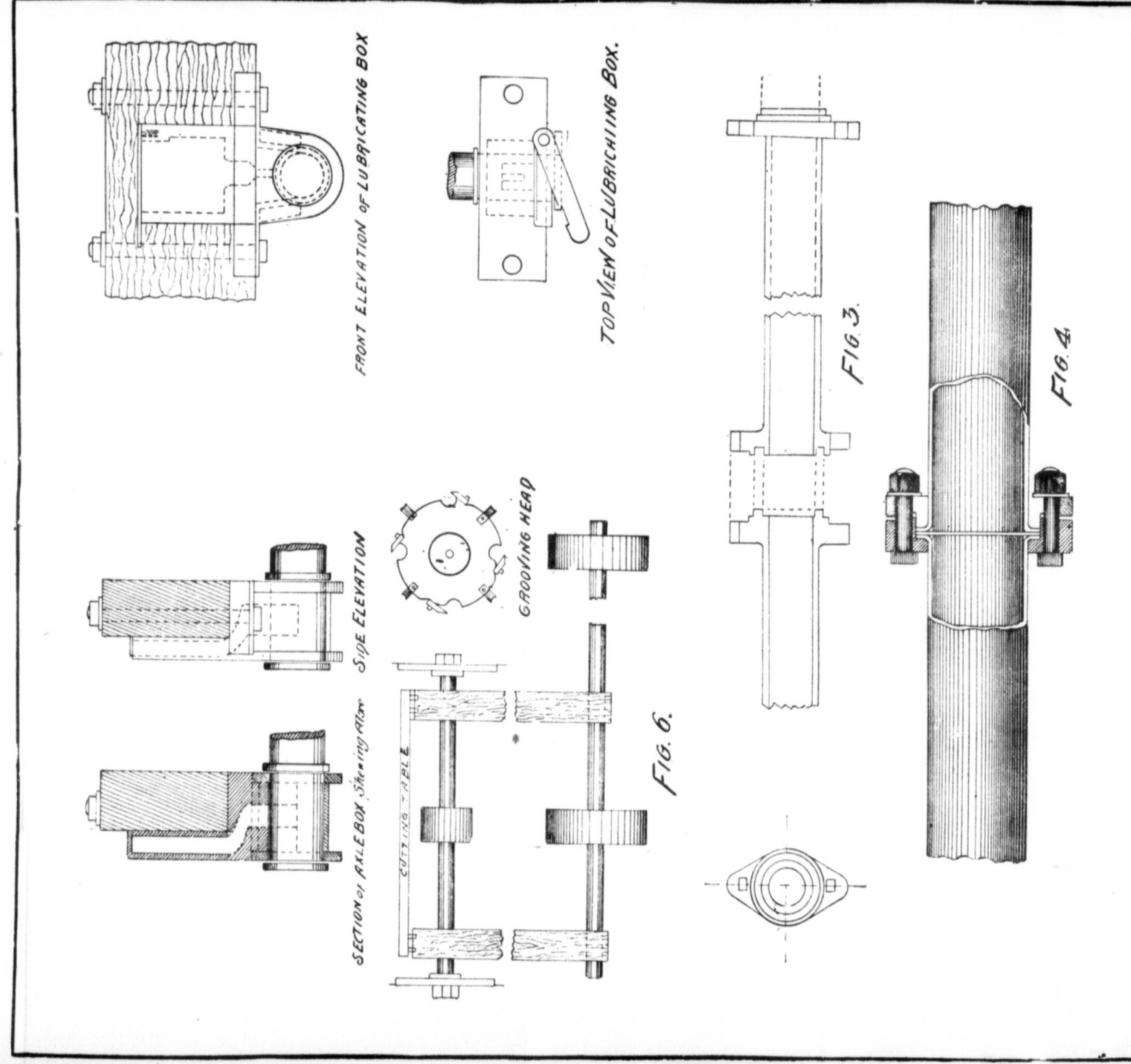
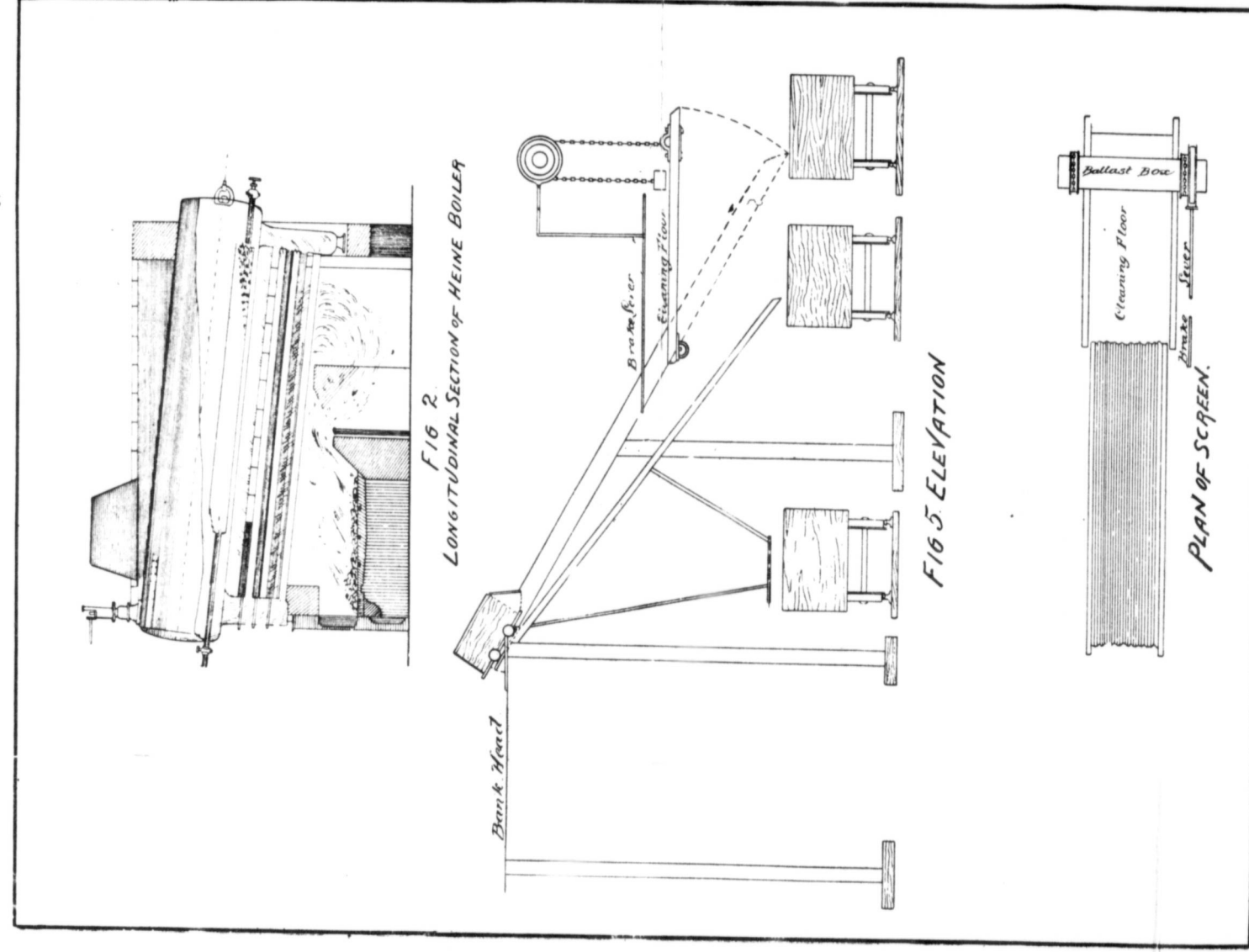
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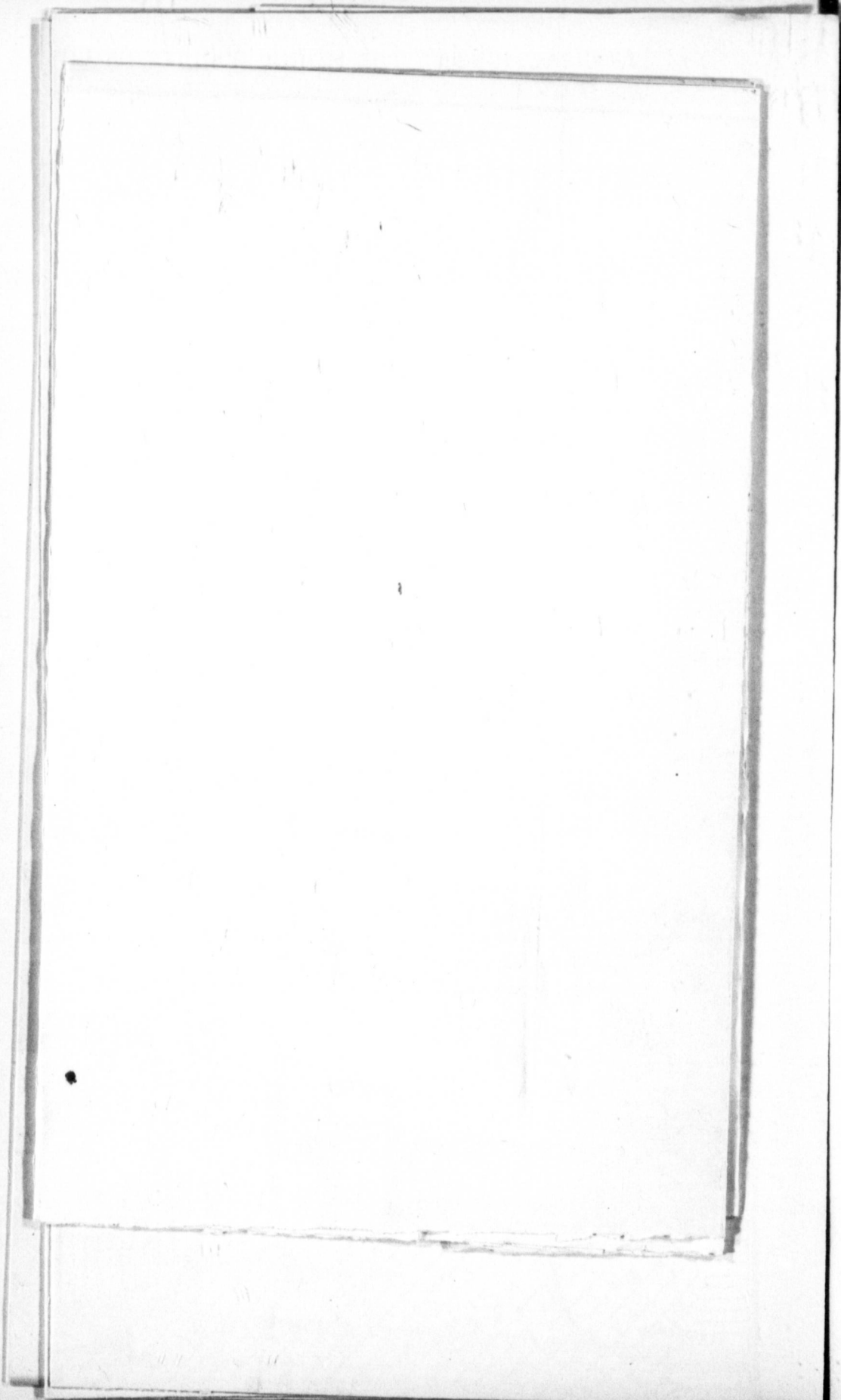


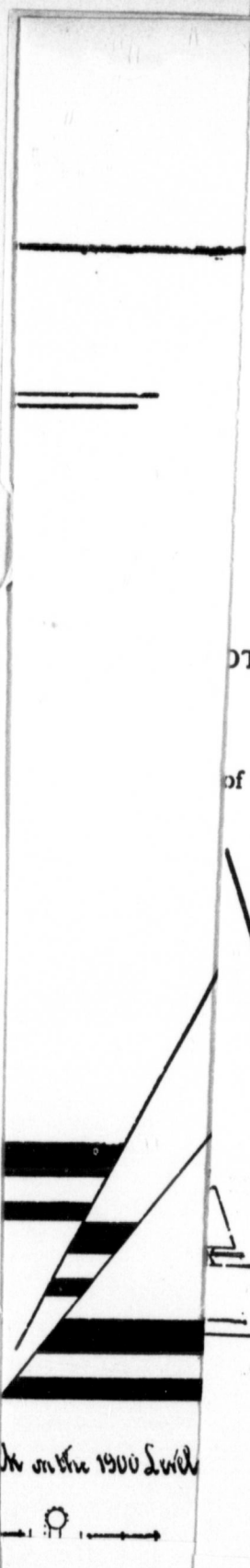




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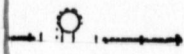


Plate IX.—Illustrating Paper by Mr. James Baird on the "Modification of Working Coal lately introduced in Nova Scotia."

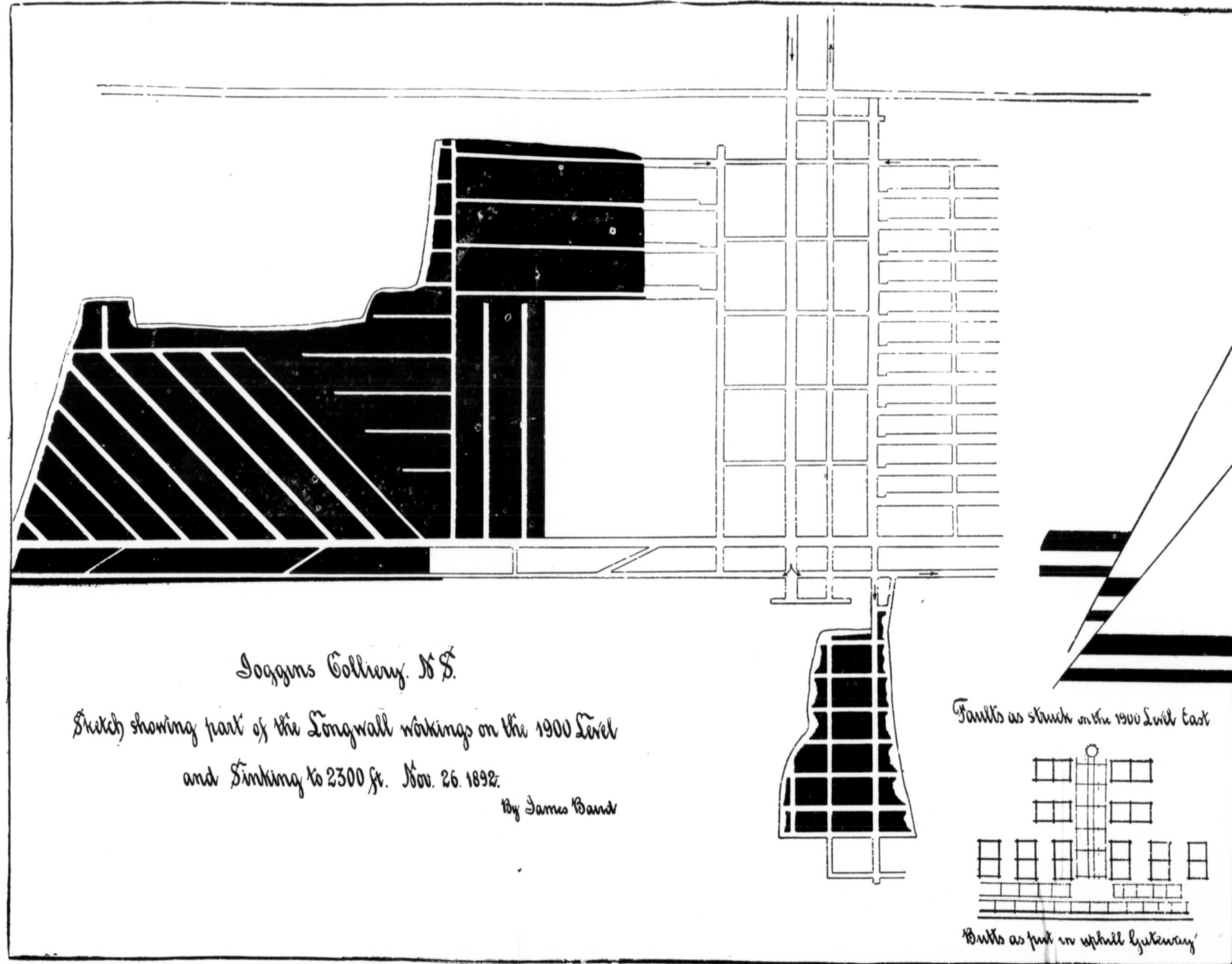


Plate X.—Illustrating Paper by Mr. Charles Archibald on the "Modification of Working Coal lately introduced in Nova Scotia."

