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THE MONTH.

We appear to have wasted last month a great deal more space on Mr. Otto Rosendale, whose real name is said to be William von Cadow, than that ingenious but hardly ingenious individual is worth, or rather this is the conclusion at which we have arrived after the perusal of a full and most entertaining account of the career of Mr. Otto Rosendale published some weeks ago in the *Pacific Miner* of Portland, and for a copy of which we are indebted to one of our readers.

The meetings of the American Mining Congress at Portland, Oregon, were held too late to admit of more than passing mention in this issue of the *MINING RECORD*. Thanks to the interest taken in the matter of having representation at this important gathering of mining men and others interested in the advancement of the mining industry by Mayor Barnard, for the City of Victoria, and Mr. Rowland Machin, for the Provincial Mining Association of British Columbia, the City and the Association were represented at the Congress by Mr. W. J. Sutton, geologist to the Esquimalt & Nanaimo Railway Company, a gentleman of known good standing in professional geological and mining circles and a member of both the Canadian and American Mining Institutes.

The *Ymir Herald* calls attention to an innovation likely to attract the notice of mining men travelling on the Nelson and Fort Sheppard Railway to the minerals occurring in the district. In the passenger train running daily between Nelson and Northport has been placed an ore cabinet for the display of samples of ore from the mining camps through which that section of the railway passes. *Ymir* has been conspicuous in recent years at Nelson and Spokane exhibitions for the excellence and variety of its exhibits of samples of gold-quartz and other ores from its mining properties. Last year it not only had the largest and best collection of gold-quartz ores then shown at Spokane, but it also won first prize for the best exhibit of a nugget of gold. Besides its lode and placer gold it has other minerals of interest, prominent among which is the silver-bearing line found in large quantity on the Hunter V. group, owned by the B. C. Standard Mining Company, of Nelson. Doubtless the travelling exhibit on the railway train will be thoroughly representative, even should space limitations necessitate its being a small one, for whatever *Ymir* has heretofore done in the direction of showing a collection of its typical minerals has been well done.

In their presentment to the Hon. the Chief Justice, on the occasion of his holding a Court of Assize at Atlin last month, the Grand Jury directed attention to the large area of mining ground in that district held under lease and upon much of which no work has been done. They asked that facilities be given the public to ascertain whether the conditions of the leases are being complied with in such cases, and recommended that, in the event of any leases being cancelled the ground they had covered shall not be again leased until after a period of thirty days shall have expired, such ground to meanwhile be open for individual location in 250-foot placer claims only. Having in mind the great advantage it is to any district where conditions are favourable to effective work to have as large a number of individual miners as possible working their own ground, we would urge upon the Government the desirability of adopting the recommendation of the Atlin Grand Jury. On some of the Atlin creeks there are numbers of individual miners working, many of them with fair success, while

on others—not all, for there are leaseholds being actively worked—there is, as stated, much ground lying unworked. As far as practicable this very undesirable state of affairs should be promptly remedied.

With characteristic inaccuracy the *Rosland Miner* recently made the statement that the Great Northern Mines owns most of the valuable claims in the Poplar Creek district. While certain individuals connected with that company are in the habit of talking at large, as it were, we hardly think it probable they would pay the Poplar Creek district such a left-handed compliment as is contained in that assertion, seeing that it has been repeatedly stated by others interested in the camp that there are a number of other properties giving promise of developing into valuable mines. If, however, this almost exclusive claim has been made, local claim-owners may well say "save us from our friends" when professed friends are so reckless as to make and publish such a statement, which surely is not borne out by facts. We have no good reason for inclining to the belief that the Great Northern Mines holds, in the Lucky Jack and Swede groups, valuable as they are generally believed to be, anything approaching a monopoly of the valuable properties of the Poplar district. Information from disinterested and reliable sources has been made public from time to time that indicates the probabilities of the occurrence of deposits of valuable mineral outside the charmed zone controlled by the Great Northern Mines, and 'tis only fair to the Poplar camp to give wide publicity to this fact. There are, though, essentials to full confidence in the camp becoming wide-spread, and one of these was lately pointed out by the *Nelson Daily News* in the following timely comment: "Good news continues to come in from the Poplar camp which indicates that the camp is even better than was expected. What is wanted there now is to make a showing in the way of production. With a couple of stamp mills in operation to which the mine owners could bring their ores for reduction the capabilities of the camp could be demonstrated, in a practical way. Once this was done there would be no question of capital to develop the several meritorious properties which are there. It is up to those interested in Poplar to do something in this direction."

We are not aware whether or not the attention of the representative of the Lanyon Zinc Company, of Iola, Kansas, who last month returned from a visit to the Quatsino Sound district, on the north-west coast of Vancouver Island, was attracted either directly or indirectly, to the zinc possibilities of that region by the publication in the Report of the Minister of Mines for 1903 of the report of the Provincial Assayer, who mentioned the occurrence on the Peerless mineral claim of "an ore body 30 feet wide of nearly solid zinc blende," but we call attention to the suggestive fact that within three months of the publication of that report the particular property mentioned in con-

nection with the occurrence of zinc ore in that region has been visited by one whose especial business it is to keep his principals advised as to the zinc resources of this Province. The exploitation of the zinc ore showings of Quatsino is stated to be a probable outcome of that visit, and while in any case it will be a matter for general congratulation to have such a desirable result achieved, it would doubtless be a source of much satisfaction to the Department of Mines to have definite assurance that it contributed to the bringing about of this result by directing attention to the occurrence of zinc ore in the district. Whilst there should be little doubt that the official reports published by the Department really do lead to good results from time to time, notwithstanding the tendency occasionally displayed to question their usefulness, in the nature of things it is not easy to point out specific instances wherein they have done good service, hence this desire to give credit in one case in which it appears to be merited.

We publish this month an abstract from a paper on Gold-Saving on Dredges in New Zealand, which deals with the latest improvements suggested by experience in that country. The article is illustrated by a block, kindly lent by the Department of Mines of this Province, which will serve to give those of our readers who are interested in this subject a general idea of the nature of modern gold-saving appliances used in New Zealand, in which country dredge-mining is an important branch of the mining industry. The Minister of Mines for New Zealand last year in the course of his annual statement to Parliament relative to the growth of the mining industry of that colony, gave the following particulars of dredge-mining: "The total number of dredges, according to the returns to the 31st December last, is as follows: Working, 201; standing, 52; building, 23; under removal, 14; wrecked, 2; total, 292. This shows an increase of 18 working dredges as compared with those actually employed at the end of 1901. The industry may be said to have fairly settled down after the excitement of the 'boom' period, and steady returns can reasonably be expected from this branch of mining for a considerable time to come. In some instances dredges were placed on claims which were more suitable to the method of hydraulic mining, and have been superseded by the latter system. In others it was found that much stronger machinery was required to work the tight wash frequently met with than is necessary for the more free gravels, and the experience so gained should be of value in the future design and construction of dredges intended for such wash. The general design of dredges has been fairly well settled by experience, but improvements in the details of working arrangements, and in respect to the methods of saving fine gold continue to be made from time to time." Of the 7,591 alluvial or placer miners employed in the colony during the year under notice more than one-fifth were employed on dredges, the majority of which require seven or eight men each

to work them. British Columbia dredge-mining is in its infancy, so the Province can learn much from the considerable experience of New Zealand, where much success is being achieved after many failures had taught the best methods to be employed.

Convincing testimony to the substantial improvement that has taken place in the condition of the mining industry of the Slocan and other silver-lead producing sections of the Province may be found in the address of the president of the organization known as the Associated Silver-Lead Mines of British Columbia, which held its annual meeting at Sandon, Slocan, last month. The association has for its particular objects the protection and advancement of the silver-lead mining industry of the Province, and its persistent activity in presenting facts and figures showing some of the causes of the depressed condition of the industry prior to the granting of the lead bounty by the Dominion Parliament and indicating the direction in which effective assistance could be rendered to bring about a change for the better, has been mainly instrumental in securing to the Slocan, Ainsworth, East Kootenay and other parts benefitting materially from the resumption of production on a comparatively large scale by the silver-lead mines, the period of prosperity they are now experiencing. The enthusiasm of the president, Mr. Alfred C. Garde, resident manager of the Payne Consolidated Mining Company, in his zealous labours in the interests of both the silver-lead and zinc mining industries—the latter being especially indebted to him for his untiring efforts to make it a commercial success—is such that the association did well, if we may be permitted to say so, in re-electing him as its official head. The prospects for both the industries just mentioned, which from the association of silver, lead and zinc in the ores of many of the mines, are to a considerable extent bound up together, are decidedly encouraging, and we have no doubt the value of the mineral production of these mines will this year be large. Another gratifying result, at least in several instances, will be a resumption of dividend-paying. Already a commencement has been made, for the Slocan Star last month paid a dividend totalling \$25,000 and not long ago the Sunset distributed \$8,000 among its few fortunate owners. It is not too much to expect that this will be the best year in respect to profit-earning the Slocan has had since its most flourishing days, and we are heartily glad that conditions appear to warrant this anticipation.

A short but very expressive sentence occasionally heard is contained in the two words "Money Talks." In mining matters it is profits that talk. The Slocan *Drill* gives an instance of this kind of talk which not only affords much gratification locally but is of the right ring to carry conviction in quarters where it may do material service in the direction of influencing others to put money into British Columbia mining properties. The *Drill* says: "The mines of the dry

ore belt pay handsomely with careful management, as note the Ottawa. Thos. A. Noble, one of the owners of the mine, states that during the month of July the ore shipped netted \$24,533.70 over and above freight and treatment charges. The expenses of the mine average a little over \$4,000 a month, leaving a net profit of \$20,000. The mine has paid for itself in two years and is rated as being worth \$250,000. Where mines in this division are given fair treatment they pay, and pay well."

Recently the Ottawa was visited by the representative of a Denver, Colorado machinery firm. That gentleman's impressions were given publicity; he is reported to have remarked "The Ottawa has proved an agreeable surprise to me. Its record of paying for its purchase and development in two years, is as unique as it is remarkable, especially as the value of the mine is now infinitely greater than it could have been at the time of its purchase." When the Denver visitor returns to Colorado his account of what he saw in the Slocan may arouse more than a passing interest in the high-grade silver properties of that district. The Ottawa is owned by two Pittsburg, Pa., men, who are so pleased with it that they are extending their holdings in the "dry ore belt" of the Slocan City mining division. This is not a solitary instance of the effectiveness of the talk of profits. Some time since a Chicago man was induced to put some money into the Providence Company's enterprise at Greenwood. When profits began to be made, as they soon did, he visited the district looking for other opportunities to acquire promising mining interests, and since then he has brought in friends on a similar errand. And there are others. Truly "profits talk," not so much to newspapers that publish highly-coloured accounts of rich specimens and high assays, as to men ready to spend money in legitimate mining development promising a profitable return.

In our June issue we made brief reference to the expected early completion of the converter plant the British Columbia Copper Company was installing at its smelter at Greenwood, in the Boundary district. This plant has since been completed and is now in successful operation, so that the Bessemerizing of the copper matte produced by the blast furnaces of the smelter is effected on the spot and the final product of the works is now a 99 per cent. blister copper instead of, as formerly, a 45 per cent. copper matte. This means that instead of the matte being sent to the United States for the purpose, it is converted into copper where it is made. The final process of refining, to separate the gold and silver contained in the blister copper from that metal, has still to be done elsewhere, but, in view of the advances made in British Columbia during the last few years, it is not too much to expect that the Province will possess its own refinery in the course of another year or two. When the B. C. Copper Company was erecting its smelter the announcement that it was planned to add Bessemer works in the near future was regarded by many as an optimistic forecast, pleasing but over-sanguine.

Now, however, this almost indispensable accessory to a modern copper smelter is an accomplished fact, and we take pleasure in offering the company our sincere congratulations on its having made this further important advance. The company's resident head officials are workers rather than talkers, so that the excellent work they have done and are continuing to do has not been and is not given nearly so much publicity as the doings of others whose achievements may possibly be more in the direction of working the public rather than in actual mining and smelting; yet they have faithfully and successfully done their part in demonstrating the practicability of mining and treating the low-grade copper ores of the Boundary at a profit, and we are glad to bear testimony to this fact. The Boundary is fortunate in having two such companies as the Granby and the B. C. Copper Company working along such lines as characterise their operations. Had it been otherwise it is certain that the district would not now hold the prominent position of being the largest producer of copper in Canada. May it not only retain this prominence but, by the more extensive development of its enormous mineral resources, make it still more striking.

In the July number of the *MINING RECORD* we published a brief abstract of a lengthy paper, by Mr. Eugene Coste, E.M., on "The Volcanic Origin of Natural Gas and Petroleum," read at last year's Annual Meeting of the Canadian Mining Institute and afterwards issued in pamphlet form by that institution. This month we give an abstract of a chapter—on the "Origin of Oil and Gas, and the Geological Conditions under which they are Found,"—of a bulletin, published by the Geological Survey of Ohio, U.S.A., on "The Occurrence and Exploitation of Petroleum and Natural Gas in Ohio," by Professor J. A. Bownocker, Assistant State Geologist. In his letter of transmittal to the Governor of Ohio last December, Professor Edward Orton, Jr., State Geologist, observed that "This topic has been previously carefully studied by the Ohio Survey and elaborate reports upon it were issued in 1886, 1888 and 1890, presenting the facts then known. During the next ten years the industry continued to make rapid progress in extent and value of output. No further investigations were authorized until 1900, when the Legislature again made appropriations for the work of the Geological Survey. This topic was considered as among the most urgent of all those presenting themselves for attention, and it was at once determined to bring the records of the discoveries and production of oil and gas down to date, while the facts were still available. Accordingly, in June, 1900, I appointed Professor John Adams Bownocker, of the Ohio State University, to take up the study of this subject, and he has pursued the same with great energy during the past three years. I submit the results of his labours with confidence that they will not only be found of great economic and scientific value at present, but also that their value will become increasingly apparent as time goes

on. There seems good ground for believing that the supply of oil and gas is short-lived. It was discovered but a few decades ago, yet we have already witnessed the rapid exhaustion of many important fields. It becomes doubly important, therefore, that we shall preserve while we can the most complete and detailed records of its discovery and use. It is believed that the present report, in connection with those before issued, will accomplish these ends, with credit to the State." In view of the fact that endeavours are now being made to determine whether or not petroleum occurs in British Columbia, and if so to turn it to practical account, it would appear that there is sufficient general interest in the subject to warrant the reproduction of information bearing upon it. In condensing Professor Bownocker's observations much interesting detail necessarily has had to be omitted, particularly the examples he quotes of Ohio or other oil or gas fields to support the several theories dealt with. However, it is probable the bulletin is obtainable from the Geological Survey of Ohio, and if so, those sufficiently interested can obtain for themselves copies for their fuller information.

The *Canadian Mining Review* criticises at some length the more prominent features of the prospects of the Imperial Coal and Coke Company, Ltd. It will be remembered that in our June issue we called attention to some ridiculous assertions reported to have been made in Spokane by one of those prominently associated with this promotion, which we have yet to be satisfied deserves the confidence of the public as an enterprise that would within a reasonable time prove profit-earning. It is not necessary for us to enumerate the categorically-stated objections of the *Mining Review*, which on the whole we think well taken, although perhaps incorrect in some particulars. Our contemporary closes with this observation: "The crux of the whole question is in the market, and that is already so glutted that it is a certainty that all the companies now operating cannot continue to do so. To increase the number at present is suicidal." While not prepared to give an unqualified assent to this sweeping conclusion, we recall that last January, when mentioning the announcement, then just made, that a company had been organized in Montreal to develop the Fording River coal areas, we remarked, "There is no longer, as at one period, any complaint as to the adequacy of the coal and coke supply, and the largest consumer of coke, the Granby Company, is about to supply its own needs by the operation of coal measures near Blairmore. As a question of increased production, it is a well known fact that market limitations and not any other reasons, prohibit any very considerable extension of the export-trade in connection with the operation of the Crow's Nest collieries." The position to-day is that the International Coal and Coke Company (organized by prominent Granby Company men), particulars of whose enterprise appear elsewhere in this issue, are now in position to commence coke-making, while the West Canadian Collieries Company, also operating in the

grade of material in one operation can be and probably are run at a lower cost per ton of ore smelted than is possible under existing conditions in the Boundary; but then, the advantages mentioned are either wholly or in part offset by the frequent necessity for using barren fluxing material. The larger smelters, say of Tennessee for instance, may fairly claim to have improved methods of treatment as compared with even the modern practice followed in the Boundary, and these contribute to a reduction in the consumption of coke to approximately 3 per cent. as compared with 12 and 13 per cent. in the Boundary. These are among the reasons that lay open to question the unqualified statement that the cheapest smelting practice extant is in British Columbia. As to the anticipation of a possible further reduction in smelting costs, no prudent metallurgist will lose sight of the fact that already there exists in the Boundary a necessity to conserve iron ores. This is no secret, for last April the *MINING RECORD* published a contribution by the resident representative of a well-known smelting company in which the following occurred: "To guard against possible scarcity of iron fluxes it has, therefore, become the general practice to conserve the iron ores of the mines." Where, we may ask, will be the suggested reduction of smelting costs if it be found necessary, as a year or two hence it may be, to bring in iron flux from distant points? We are not alarmists in this matter, but it is a duty to dispel illusions even when such a course is not an agreeable one.

In regard to whether British Columbia coal companies burn their coke sufficiently long, Mr. Campbell-Johnston states that their present practice is to coke the coal in the ovens for only twenty-four hours. We doubt the accuracy of this statement and we think that Mr. Campbell-Johnston has not sufficient justification to warrant him in spreading it broadcast throughout the British mining world. The information given to us by men employed in the work of coke-making at the collieries of the Crow's Nest Pass Coal Company is that they burn the coke from sixty to seventy-two hours, and we were shown scores of ovens with the coke at one or the other of the stages of one, two or three days' burning. Then we have authority that we accept without hesitation for the statement that the Union (Vancouver Island) coke is seventy-two-hour coke, and that physically it is hard, compact and well-suited to stand the burden of the charge in the blast furnace. We have before us the average analysis of a large quantity of coke from these ovens; it is as follows: Volatile hydro-carbons, 6.94 per cent.; fixed carbon, 68.64 per cent.; ash, 22.16 per cent., and sulphur 2.30 per cent.

Perhaps we ought not to take Mr. Campbell-Johnston so seriously, for doubtless he means well, notwithstanding that he seems to sometimes mix things up badly.

MR. S. F. PARRISH AND THE LE ROI MINE.

IN a recent letter to the *MINING RECORD* Mr. S. F. Parrish, the late general manager of the Le Roi mine, writes: "So much has been said in both the English and American papers about the Le Roi and my management of it that was untrue and unjust to me that it seems almost forced upon me to say something in reply. At first I felt that the right thing to do was to let it go and pay no attention to it, but as in your journal you were kind enough to say that judgment should be suspended until I had been heard from, I have written the enclosed statement of facts, making it as concise as I could. More could be said, but it is unnecessary.

"In a large degree the whole trouble arose from the monthly publication of estimated values, a pernicious custom which a majority of the Board of the Le Roi Mining Company insist upon keeping up; this and the endeavour to harmonise the legitimate business of mining for what there is in the mine with speculating in the stock of that mine—the two occupations have nothing in common."

In his statement of the case Mr. Parrish says:—

"In view of the fact that numerous articles have appeared in the American as well as in the English press concerning the Le Roi mine at Rossland, British Columbia, it is but right that some facts relative to this property be placed before those interested in mining, as they are of importance. With this end in view I am glad to avail myself of the courtesy of the *MINING RECORD* to give them publicity.

"When, in February, 1903, I took charge of the Le Roi mine, and the smelter at Northport, Washington, I was informed by my predecessor, Mr. John H. Mackenzie, that the mine was about worked out and its life would continue not to exceed six months, or into the summer of that year. The necessity of immediately inaugurating a plan of prospecting, and putting it into action, was apparent, and it was done. Diamond drill holes and cross-cuts were made to the south of the old workings into entirely new territory, with satisfactory results in many instances. On the bottom or 1350-ft. level, 1200 feet vertical depth from the surface, the result was very valuable, disclosing, as it did in places bodies of merchantable ore; valuable not only to the Le Roi mine but to the Rossland camp in general, the discovery demonstrating, for the first time on Red Mountain, the existence of ore at great depth. In addition to finding this solid ore, a highly mineralized zone, extending the entire length of the claim, was found, opening a large field for warranted prospecting. So successful was this work that upon my retiring from the general managership of the affairs of the company on June 1 last there was as much (if not more) ore in sight in the mine as at any previous time in its history.

"The method, adopted some years ago, of sampling the output of the mine at the mine had only recently been actually proved to be faulty, although both the late Mr. Oscar Szontagh, former manager of the Northport smelter, and Mr. E. J. Wilson, the present

incumbent, maintained that the ore did not carry the values represented by the mine sampling. The attention of the company was drawn to this fact several years ago, but no action was taken in the matter until I decided that in the interest of all concerned a method of accurate sampling must be adopted, not only for the protection of the mine itself but to establish a reputation for the smelter as being beyond doubt accurate in its sampling and so assist it in its endeavour to build up a custom business. With this end in view I purchased, in October, 1903, a Vezin sampler, which was to have been delivered at the smelter in 90 days, but owing to unavoidable delays it was not installed until April, 1904. Upon its installation the first accurate sampling of the Le Roi Company's ore in quantity was made possible, and the inaccuracy of the mine sampling proven.

"The absence of accurate facilities for this work created annually, as can be understood, a great difference between the values as represented by the mine sampling and the value of the smelter products. A pernicious custom was instituted by the home office of the company of mailing monthly to the shareholders an estimated value of the mine product, which has led, as can be readily seen, to disastrous results to those who, on the strength of such information, speculated in the company's shares. During the months of January, February and March last, the mine output was increased and the sampling at the mine showed much higher values than the ore contained, and losses to individuals speculating in the company's shares became a serious matter. The intimation that anybody connected with the mine profited by the faulty sampling and the erroneous statements of estimated values, is absolutely without foundation in fact.

"The recent sampling of the mine, the result of which was to give \$8.15 per ton as the value of the ore in the mine, I do not consider as fair; stope and drift faces vary in value and character from day to day, the values being very unevenly distributed through the ore; the face may be in pay ore to-day and in a few days in ore difficult to handle profitably.

"The conditions under which I assumed the management of the mine were such that it was either a question of abandoning it or spending a large sum of money in search of more ore. I took the latter alternative and the mine is still shipping ore and, I am informed, contemplates installing a concentrating plant."

Our readers will, we think, with this straightforward explanation before them, unanimously agree that Mr. Parrish has most effectually replied to the cruel and baseless insinuations of the London *Financial Times* and other newspapers, which suggested that his serious indisposition at the time the more recent errors in estimating the value of the Le Roi output were made was merely a somewhat "convenient" co-incidence. Meanwhile, it is surely a very extraordinary state of affairs, to which Mr. Parrish directs attention, when he intimates that "for several years" the sampling at the mine has been inaccurate,

that on different occasions two smelter managers complained of these inaccuracies and that the directors or whoever were responsible, seemingly ignored these representations, although the actual smelter returns must have clearly shown that the smelter manager's complaints were well-founded. But, as Mr. Parrish points out, the result of faulty sampling at the mine would be of relatively small moment, so far as the actual interests of shareholders were concerned, were it not for the injudicious policy adopted by the Board of publishing periodical statements wherein the value of the ore produced each month is "estimated" by the mine manager. We of course admit that in pursuing this policy the directors were actuated by motives distinctly honourable and well-intentioned: the object being, probably, to afford shareholders the latest possible information—directly that information was at all available—concerning the progress of mine operations. But at the best, the practice of issuing monthly returns, which is peculiar to English mining companies, is a foolish, even a dangerous, one and especially so in cases, such as that of the Le Roi, when any attempt is made to give information not absolutely verified. If only the business of mining, by which is meant the actual industry of profitably extracting the precious and base minerals from their ores, and the business of speculating in the shares of those companies who engage in this industry, could be disassociated; if boards of directors could afford to ignore the stock markets altogether, and would devote their sole energies to the conscientious performance of their duties, it is very certain that mining would soon cease to be regarded by the general public as a sort of gambling game, not so exciting as poker, and rather more risky than backing the favorite for the Derby.

AN UNFAIR REFLECTION.

FROM the London *Critic* of August 6 we quote the following: "Apropos of the rumours of a scheme being on foot for the amalgamation of the Le Roi group of companies with certain other Rossland undertakings, which are under the control of the Gooderham-Blackstock Syndicate of Toronto, it is of interest to note that the Rossland correspondent of the New York *Tribune* asserts that these reports are well-founded, but that the proposed 'merger' will, if adopted, be far from advantageous to the shareholders in the Le Roi group. It is alleged that the Gooderham-Blackstock mines are practically denuded of good ore, and that by joining the proposed amalgamation the Le Roi would risk the opportunity it still has of retrieving its fortunes by a steady adherence to business principles." Before noticing the allegation affecting the Gooderham-Blackstock mines (which are the Centre Star and War Eagle), we must express our sense of gratitude for the above admission that the Le Roi Company actually has an opportunity of retrieving its fortunes, for we might naturally have expected that the correspondent who, as alleged, threw doubt

on the commercial value of the Gooderham-Blackstock mines would have similarly reflected on the Le Roi, seeing that all three mines are in much the same condition as regards the comparative exhaustion of their "good ore" and the possession of the large bodies of lower grade ore they have exposed, with this exception that the Le Roi has opened up important shoots of ore at deeper levels than the other mines have yet reached. Passing by the incorrect reference to the "Le Roi group of companies" we have to remark that the Le Roi Mining Company—not group of companies—has not made any secret of the fact that negotiations have been in progress with a view to amalgamation as suggested. On the same date as the publication by the *Critic* of the above-quoted paragraph the *B. C. Review*, also published in London, gave its readers an account of an interview with Mr. A. J. McMillan, managing director of the Le Roi Mining Company, in which it stated that:—

"In answer to a question as to the truth of reports of an amalgamation of several of the big mining companies in British Columbia, Mr. McMillan said it was quite true that negotiations were on foot looking to the possible amalgamation of several of the largest companies engaged in mining in that district, all of the mines concerned being well developed and well equipped, and each capable of producing a large daily tonnage of ore. He further expressed the opinion that there would be many advantages in one company owning various mines with a large tonnage of ore of different kinds, and also owning smelters and mills, thus keeping within the company all the profits available. As nearly all the mines of British Columbia contain much low-grade ore, it is desirable that they should be operated on a large scale, and thus secure all the advantages of economy in management."

As regards the ore reserves and producing capabilities of the Centre Star and War Eagle mines there are no mining companies in British Columbia that publish fuller particulars of their operations, costs, and results than do the companies owning these mines, so that even if the first advances in the direction of amalgamation had been made by these companies—which it is understood was not the case—there had been unusual candour shown in making it clear how these mines stood in the matter of development and production. Full information taken from the last annual reports of these companies on these points, has already been published in this journal. From these reports it is gathered that "Developments up to date show that these mines have experienced the same general change in the character of their ore deposits which has occurred in all other productive mines in the Rossland district, and which is the general rule throughout the mining districts of the world. This is the transition from the occurrence of high-grade bonanza ore bodies, capable of profit under the expensive process of smelting to masses of lower grade, requiring a cheaper treatment by milling.

"As the bodies of smelting ore in the vein become less frequent and their average size diminishes, the proportion of this ore to the increasing quantity of

development or dead work required to expose it rapidly lessens to a point where its profit is consumed by the cost of the dead work. The relief to be derived from milling will, therefore, be not only in the direct saving of cost expected, but also in the increased proportion of pay ore to development work, while the stoping of low-grade blocks will assist the exploration work by disclosing the unknown bodies of smelting ore contained within their limits.

"The development work of the year has continued to add to the great masses of ore too low in grade for smelting, but rich enough to afford a profit to successful milling. Now that the mill of the Rossland Power Company assures an outlet for these ores, their contents will soon be available. It is impossible to present any reliable estimate of their quantity or precise value, because their limits have not been defined, and until milling begins they cannot be exposed or sampled accurately without excessive expense. They occur in extensive bodies 15 to 30 feet in width, and exposed very imperfectly by the mine workings, since these have been in the past directed to the exposure of smelting ore bodies only.

"The necessity for milling has long been foreseen, but although every effort has been made towards the desired end there has been unexpected delay, owing to unusual difficulties and obstacles. The technical problem presented by the nature of the ore has been a serious one, and the business arrangements necessary for success have also taken time."

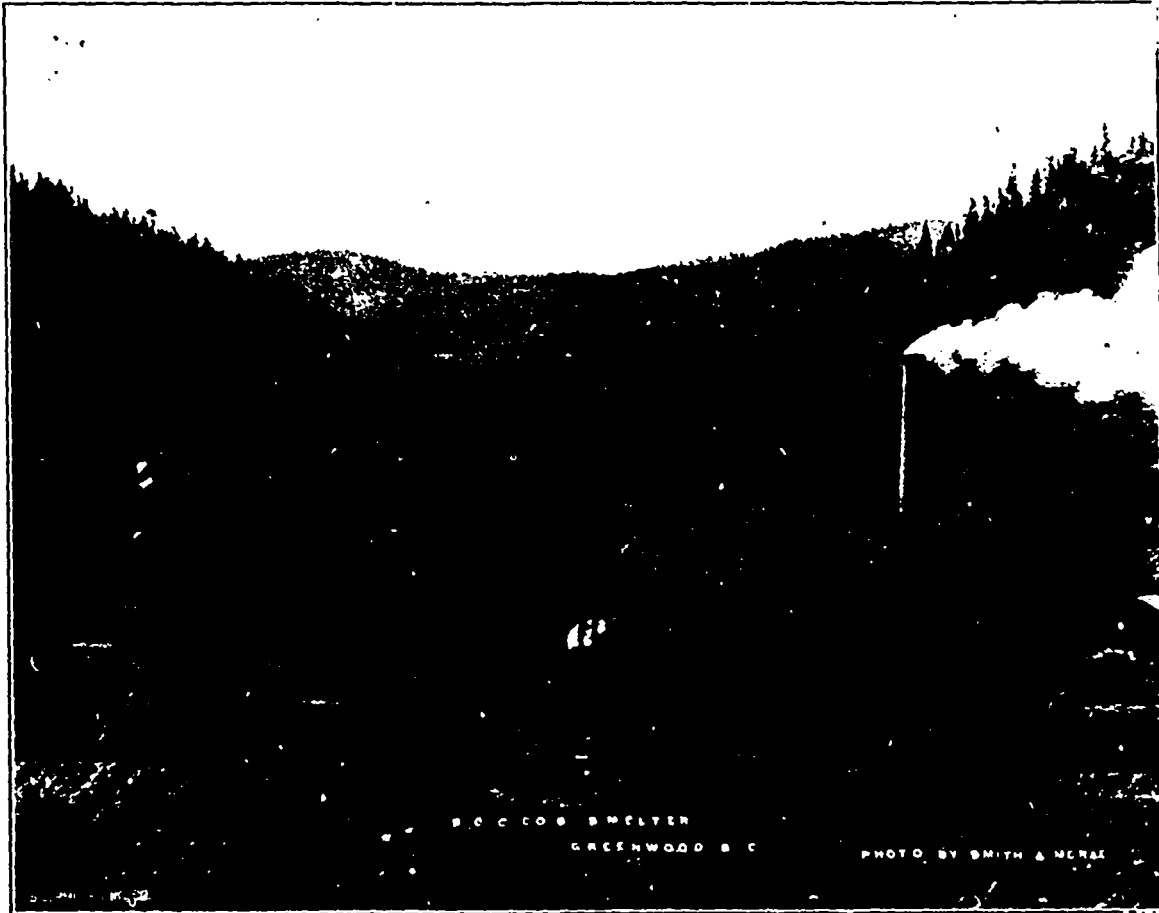
The output of the Centre Star mine last year was 88,387 tons, averaging \$10.58 per ton, smelter's gross assay value. The net profit in excess of all expenditures was \$228,358.90. The War Eagle's ore sales were 60,030 tons, averaging \$13 full assay value, or \$9.87 smelter's gross assay value. The excess of revenue over expenditure was \$68,512.21. (For reasons stated, War Eagle costs are higher than those of the Centre Star.)

At present we are in no sense expressing an opinion as to the desirability or otherwise of the suggested amalgamation, but are endeavouring to show that reflections on the value of the Centre Star and War Eagle mines along the lines that appear to have been adopted in the correspondence commented on by the *Critic* do not fairly indicate the real position. With the exception of the deeper development of the Le Roi, there is much in common in the situation as it affects the three mines concerned, which are adjoining properties or the same veins or bodies of ore. Further, both the "Gooderham-Blackstock" companies made substantial profits last year, and those in control of them have lately shown in a very practical manner,—viz., by financing the Rossland Power Company's enterprise in erecting the large concentrating works now treating the lower grade ores of the Centre Star and War Eagle mines—their confidence in their ability to continue to make money out of their mines. When they undertook the large expenditure involved in the establishment of these works there was no suggestion of amalgamation; they honestly believed the value of the ore reserves in their

mines warranted the outlay necessary to make these profitable, so they built and equipped the modern concentrator now in operation at Trail. If they agree to the proposed amalgamation it will be because by operating on a larger scale they would enjoy greater advantages and earn larger profits, not because the condition of their own mines and concentrating works by any means makes such a joining of forces essential to the continued financial success of their own enterprises.

and installed by the present smelter superintendent, Mr. J. E. McAllister.

The smelter site adjoins the town of Greenwood. The Canadian Pacific Company's Columbia and Western Railway to Midway, giving rail connection with Rossland, Trail and Nelson, runs just below the works, while the Deadwood branch of the same system passes immediately above. Connecting tracks have been constructed at three levels—a double track over the upper ore bins, for the delivery of ore to be



No. 1.—General View of B. C. Copper Co.'s Smelting Works.

BRITISH COLUMBIA COPPER COMPANY'S SMELTER AT GREENWOOD, BOUND- ARY DISTRICT.

THE British Columbia Copper Company's smelting works, at Greenwood, Boundary District, were designed and constructed in 1899-1900 by Mr. Paul Johnson, E.M. They were planned with a view to eventual enlargement to a maximum treatment capacity of about 1,800 tons per diem. Their present capacity, with two furnaces running, is between 700 and 800 tons of ore per day. The first furnace was blown in on February 17, 1901; the second was completed in the earlier half of 1902. Recently a Bessemerizing plant was added, thus having been designed

passed through the sample mill; a triple track over the smelter mixture bins and above the fuel yard, and a single track below the converter building, this last for the delivery of stores and the shipment of the copper product.

The works may be briefly described as follows:—Starting from the top, the upper ore bins come first. There are six of these, each of 500 tons capacity, built in two parallel rows. An elevated tramway connects these with the sample mill building, which is a three-story frame structure 70 x 65 and 58 feet high to the eaves. Its full capacity when it shall be supplied with the requisite ore bins, etc., will be about 3,000 tons, but present arrangements only include provision for a smaller quantity. The building is large enough for three sets of sampling and crushing

plant, but as yet only one set has been put in. This comprises three Gates rock crushers of different sizes, one pair Cornish rolls, one sample grinder, and three automatic samplers. The sample mill has been constructed on the automatic principle with samplers designed to avoid elevating the material before crushing. Under these arrangements only two or four per cent., as desired, has to be elevated, the great bulk going direct to the discard bins. The lowest floor of the sample mill building is two feet higher than the top of the lower or smelter mixture ore bins. There are two sets of these bins, each twelve in number in four parallel rows, the whole

shown in illustration No. 1), gives an effective draught height of 197 feet 6 in. from the level of the blast furnace charging floor to top of stack. This brick stack was erected last year, replacing the sheet steel stack that previously carried off the fumes from the blast furnaces.

The lower part of the blast furnace house is constructed entirely of stone work and steel, and the charging floor is of cast iron plates. The building is 58 feet wide by 45 feet long, and room has been left for extending it sufficiently to accommodate three more furnaces. The furnaces are water-jacketted stack furnaces 42 in. wide by 150 in. long, inside dim-



No. 2—B. C. Copper Co.'s Smelter—Interior of Converter Building.

giving a storage capacity of about 10,000 tons. They are crossed by three parallel railway tracks over which the bulk of the ore from the company's Mother Lode mine, already crushed at the mine and consequently not having to be passed through the smelter sample mill, comes to be dumped direct into the lower bins.

The flue dust chamber is 12 feet wide by 14 feet high and its length is about 620 feet. It has thick masonry walls, brick-lined in part and arched over with brick. It rises 76 feet 6 in. to the base of a circular brick stack, 121 feet high, the inside diameter of the shaft being 12 feet. This, together with the height gained by running the flue up the hillside (as

ensions at tuyeres of which there are ten on each side of $3\frac{1}{2}$ in. diameter.

Owing to the filling of the dumping ground suitable for that purpose it became necessary to abandon the practice of granulating the slag from the furnaces, so last autumn a movable slag railway was constructed. The slag is now taken from the blast furnaces in a molten state in large side-dumping pots, tilted by a worm and worm-wheel, each pot having a holding capacity of five tons. They are hauled by a steam locomotive with 10x14 cylinders, and four drivers of 31 inches diameter.

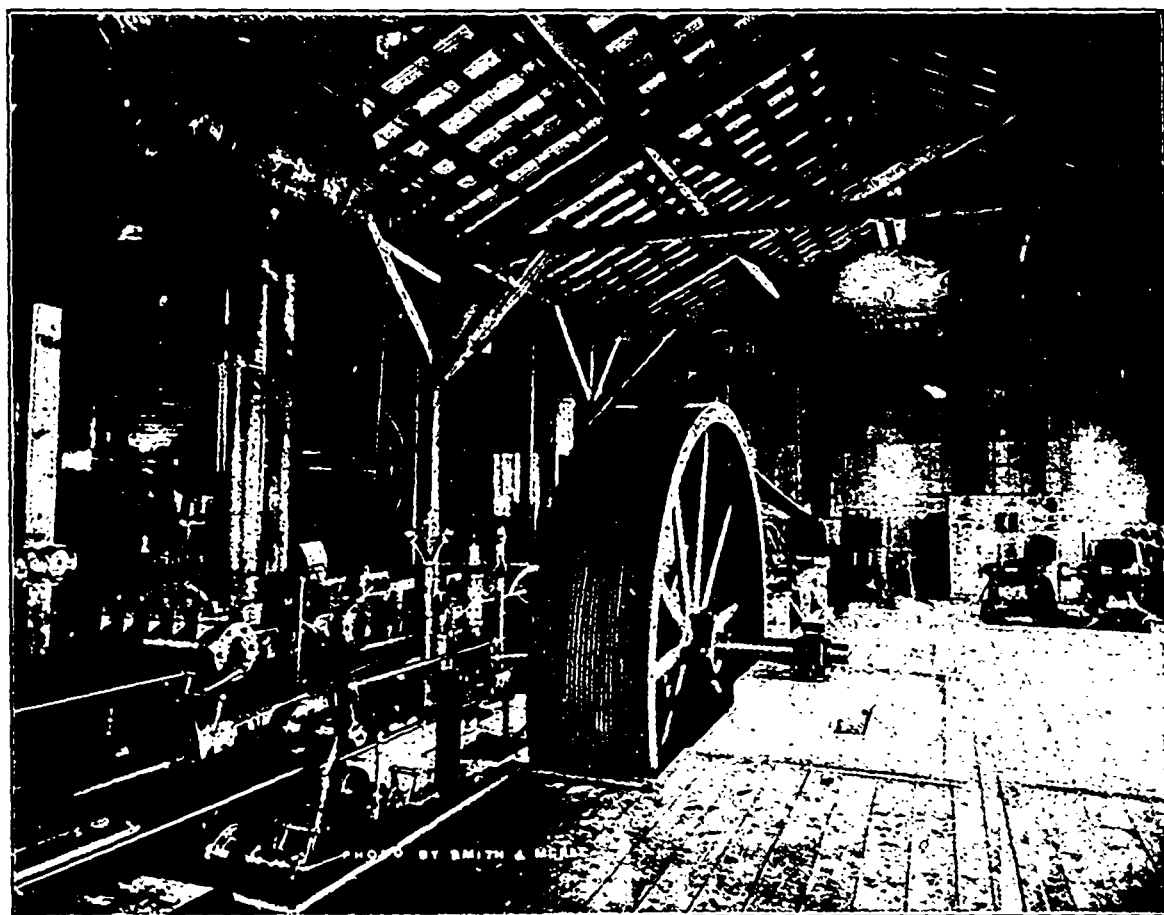
The engine and blower house, 60 ft. by 45 ft.,

contains two No. 7½ Comersville blowers, the high-pressure cylinder of a compound condensing Reynolds-Corliss engine 16x35 in. rated at 150-h. p. with 100 lbs. steam pressure, and an electric light dynamo with direct-connected engine. In the adjoining 45 ft. x 40 ft. boiler room there are three horizontal return tubular boilers 66 inches x 16 feet, each of 100-h. p. and equal to a steam pressure of 130 lbs. Space was left for housing more boilers, but as electric power has been substituted for steam power throughout the works the earlier intention to double the steam power will not now be carried out.

A Bessemerizing plant has been installed and the

The fumes from the converters are taken off by an independent stack, having first passed through steel boxes at the back of the stands, a suitably-shaped steel flue of twenty square feet cross-section, and finally a brick chamber of 285 square feet cross-section, in order to collect the flue dust, before being conducted into the stack. (The brick chamber and stack are shown in illustration No. 1, and the boxes and steel flue in illustration No. 2.)

The converting plant is housed in a steel building 46 ft. x 90 ft. with a lean-to of 60 ft. x 30 ft. At one end of this building is located the re-lining machinery. The silicious ore used for the linings passes



No. 3—B. C. Copper Co.'s Smelter—Interior of Power House.

product now turned out is 99 per cent. blister copper instead of 45 per cent. copper matte as formerly. This plant consists of two converting stands, equipped with five shells of the trough type, 84 in. in diameter and 126 in. long. The converters are tilted by power supplied by a hydraulic accumulator.

For the purpose of conveying the molten matte from the blast furnaces to the converters, and for moving the shells from their stands to the re-lining platform, an electric travelling crane is used. Four motors operate this crane, which is equipped with a main hoist of 40 tons capacity and an auxiliary hoist of ten tons.

directly from the sampling mill, through a 7 x 10 inch Blake crusher, and a set of 24 inch rolls, into a bin, from which chutes lead to a 6-ft. Carlin mixing pan. The clay used as a bond for the silicious ore of the lining is delivered by similar means into the pan which automatically discharges the mixed product, ready for tamping, in front of the converter shell. (Illustration No. 2 shows the shell in the re-lining stand at the left of the picture).

The blast for the converters is furnished by a Nordberg blowing engine with cylinder 40 in. diameter and 42 in. stroke (see illustration No. 3) having a capacity of 5,000 cubic feet of air per minute, at

12 lbs. pressure. This compressor is operated by a rope drive, the fly-wheel being 18 ft. in diameter and power furnished by a 300-h. p. variable speed motor, operating at 2,000 volts.

For the transmission of electricity the B. C. Copper Company has built a pole line, with two independent three-phase circuits, to connect with the sub-station of the Cascade Water Power & Light Co. at Phoenix, a distance of four and eight-tenth miles. This line terminates in a brick sub-station (shown at the right of illustration No. 1) containing step-down transformers from 20,000 to 2,000 volts of 1,000-h. p. capacity. From this sub-station the alternating current is transmitted at 2,000 volts to the power house (illustration No. 3) in which are located transformers with a further step-down to 550 volts.

A 75-k.w. motor generator furnishes the direct current required for travelling crane and the necessary power for trolley locomotives to be used in the immediate future; a 300-h. p. motor previously referred to, drives the Nordberg compressor; there are two 100 a. p. motors for the two blast furnace rotary blowers and one for the sample mill; a 40-h. p. motor drives the converter lining machinery; a 20-h. p. motor operates the hydraulic accumulator for tilting the converters; a 15-h. p. motor runs elevators connecting the blast furnace tapping and charging floors, and a 5-h. p. motor the sample grinding machinery. The lighting on the plant and premises is provided for by a series of transformers, each having a capacity of 150 lamps.

A briquetting plant, of a capacity of 100 tons per day, is to be at once installed to handle flue dust and concentrates. This will consist of a mould briquetting press with lime slackers, mixers and conveyor belt, the flue dust being automatically fed from a bucket elevator. This plant will be operated by a 40-h. p. induction motor.

Prior to the installation of the above described Bessemerizing plant the copper matte produced at this smelter had to be sent elsewhere to be converted into blister copper. Now this work is done on the spot, and in making provision for it the B. C. Copper Company has advanced another stage in the progressive policy it is steadily pursuing. The total tonnage of ore treated at this smelter during the three years and a half it has been in operation is in excess of 500,000 tons. Mr. McAllister has been in charge since the early part of last year, after having been for some time assistant superintendent at the Tennessee Copper Company's smelter at Copperhill, Tennessee, U. S. A., and his modern and economical metallurgical practice has been the chief factor in making the smelting works a commercial success.

The British Columbia Copper Company, Ltd., is a New York organization. It was incorporated in 1898 to acquire the Mother Lode mine, situated in Deadwood camp, which property the organizers of the company purchased in 1896 and developed from a mere prospect. Mr. Frederic Keffer, of Greenwood,

the company's general manager, has been in charge of the company's interests ever since its inception.

NOTES ON THE BRITISH COLUMBIAN ZINC PROBLEM.*

(By Alfred C. Garde.)

AFTER wrestling with the zinc problem for more than a year, the Payne Mining Company under my management decided to erect a special zinc dressing plant, and are now in a position to produce from 200 to 300 tons of desirable zinc concentrates per month. Markets for the various products have also successfully been established both in Europe and the United States, and steady shipments are now being made. Since then the other companies have followed suit and there are a number of zinc shipping mines on the list now. Besides, several of the old mills are now being reconstructed with the view of treating their zinc ores on a commercial scale which points favourably towards an increased production of this useful mineral.

Both the Ainsworth and Slocan districts came into prominence approximately twelve years ago on account of their remarkably high grade ledges of silver-lead ores. Zinc-blende was also found in ledges and in association with galena, but for ten years not the least regard was paid to the economic features of zinc. Only in one instance a certain Mr. Brown, of Manchester, in 1899, undertook to send an experimental shipment of 1800 tons of zinc-blende from the Lucky Jim mines near Sandon to one of the zinc smelters in England. The assays of this shipment average 50 per cent. zinc, 3 per cent. lead and 6 ozs. in silver, per short ton. Unfortunately, Mr. Brown died in England before the shipment reached its destination, and his well intended project came to grief with him. Since then the Lucky Jim mine fell back into obscurity; however, it is well worth noting that this property has recently been secured for a large cash consideration, and now promises to become one of the largest producers of zinc-blende in the Slocan.

It may possibly be argued that in the upper ore zones extending towards the crest and along the surface of the mountains, only a small percentage of zinc was found to be associated with the galena. This feature, however, can readily be explained as caused through corrosive action of surface water and exposure to the elements whereby the sulphides of zinc (and to quite an extent the sulphides of lead) were changed into carbonate ores. The carbonates with average contents of 80 ounces of silver, 40 per cent. lead and low in zinc, furnished an excellent smelting product on which the smelters did not impose any zinc penalty.

In several of the mines familiar to me the carbonates and galena ores free from zinc extended to a depth of 400 to 500 feet below the apex of the moun-

*Extract from a paper presented at the Sixth Annual Meeting of the Canadian Mining Institute, March, 1904.

tain, but by degrees a material percentage of zinc-blende made its appearance. In most cases under my observation this transformation took place gradually, although there were numerous instances where the zinc-blende replaced the clean galena and vice versa. The result of the steadily increasing percentage of zinc was that the lead smelters found it necessary to place a penalty of 50 cents per unit on galena containing more than 10 per cent. of zinc. This penalty was accepted by the high-grade mines of Sardon which were in a position to ship a galena product averaging from 80 to 90 ounces in silver, and 45 to 50 per cent lead. As an instance I might quote that during 1900 the Payne mine shipped 10,411 tons of galena averaging 83.79 ounces in silver, 45 per cent. lead, and 15 per cent. zinc, and that the penalty paid on zinc alone during this year amounted \$28,203.42, being equal to a deduction of \$2.71 per ton of ore shipped.

Other mines had similar experiences and found that the zinc contents, in spite of close hand-sorting, could not be kept within the 10 per cent. limit, and that different means would have to be resorted to in order to keep the galena free from excess of zinc. To overcome this difficulty mechanical concentration by water was eventually applied. Several 100-ton mills generally driven by water power, and nearly all constructed on the same plan, were built in a comparatively short time. Hartz jigs with two, or sometimes three cells, were used in separating the coarse galena from the waste rock as well as the zinc-blende and iron, all of which went through the tail-races. For the finer lead products, buddles and Frue vanners were used. The system of concentration employed often left much to be desired as to efficiency, but the point of keeping the galena contents within the zinc penalty limit was gained. From the above it will readily be seen that one of the essential features of concentration in the Kootenays was to send as much zinc through the tail-races as possible, and it must be admitted that this aim was carried out to a high degree of perfection. The tonnage of zinc thus wasted was immense, and its extent will probably never be known; it can only be roughly estimated from assays of the tail products which would often exceed 30 per cent. zinc and rarely go below 20 per cent. A considerable amount of silver contained in the blende also went into the various creeks with the tailings, but so as not to get myself into hot water, I prefer not to quote any assays. In summing up the various losses, we have:—

1. Direct loss to the mines due to zinc penalty payments.
2. Loss of zinc values in smelting lead ores high in zinc.
3. Loss of zinc and silver values run to waste, through the tail races of the various concentrators.
4. Hand sorted zinc ores left on the dumps or in the old mine stopes.

Of the above-mentioned losses the fourth item is the only one that can partly be recovered providing the material is present in sufficient quantities to permit of economic handling and concentration. At the Payne, Ruth, Ivanhoe, Wakefield and Alamo concentrators, this is now being done successfully. Furthermore, the Slocan Star, Washington, Jackson, Monitor, Rambler, and several other well known properties are now preparing to alter their present plants or erect new ones whereby they will be able to recover the "zincy" material on hand, as well as all zinc that in the regular course of mining is broken down with the lead ores. In order to give an idea of results that have been obtained, I may state that during the first ten months' run (May 31, 1902, to March 30, 1903) the Payne concentrator handled 33,000 tons of old and 7,000 tons of new stope fillings, from which 1,247 tons of high grade silver-lead concentrates were derived and sold to local smelters. In addition thereto 1,391 tons of 42-43 per cent. zinc-blende concentrates, containing 8 ozs. in silver per ton, were produced as a by-product at no extra cost. A 1,000 ton lot was disposed of to the Lanyon Zinc Company of Iola, Kansas, and netted the Payne Company, after paying an \$11 freight rate, \$8 per ton. Encouraged by these results the company at once added a magnetic separating plant, whereby they have been able to, at a cost of from \$1.50 to \$2.00 per ton, improve the zinc product from 42 per cent. to 55 per cent.

In the case of silver-lead-zinc mines situated at altitudes ranging between 1,700 and 4,000 feet, we find that the ratio of silver in the galena is of much lower tenor, or, approximately, one half ounce of silver to one per cent. of lead, while in many instances, the lead content is low and the percentage of zinc high. In the Kootenays an ore of this class is termed "low grade," and it will readily be understood that on these the penalty on zinc worked a severe hardship. In addition, the price of silver continued to decline, and when the American Smelting and Refining Company, in January 1900, withdrew from the Canadian lead market and compelled the producer in Canada to sell his lead at much lower prices in the Continental market in competition with cheap Spanish and Mexican labour, the "low grade" mines were obliged to shut down. To some considerable extent this last feature has been overcome within the past eight months by the liberal bounty of \$15 per ton granted by the Dominion Government on all lead mined and smelted in Canada. The bonus has particularly proved of great benefit to the mines in a position to produce a heavy lead ore or lead concentrates, but in order to re-open the low grade lead-zinc mines it will first be necessary for the owners of the same to make a by-product of the zinc, which may be disposed of at once if of sufficiently high grade to stand present freight charges, or be stored until such time as zinc smelting works shall be erected in British Columbia.

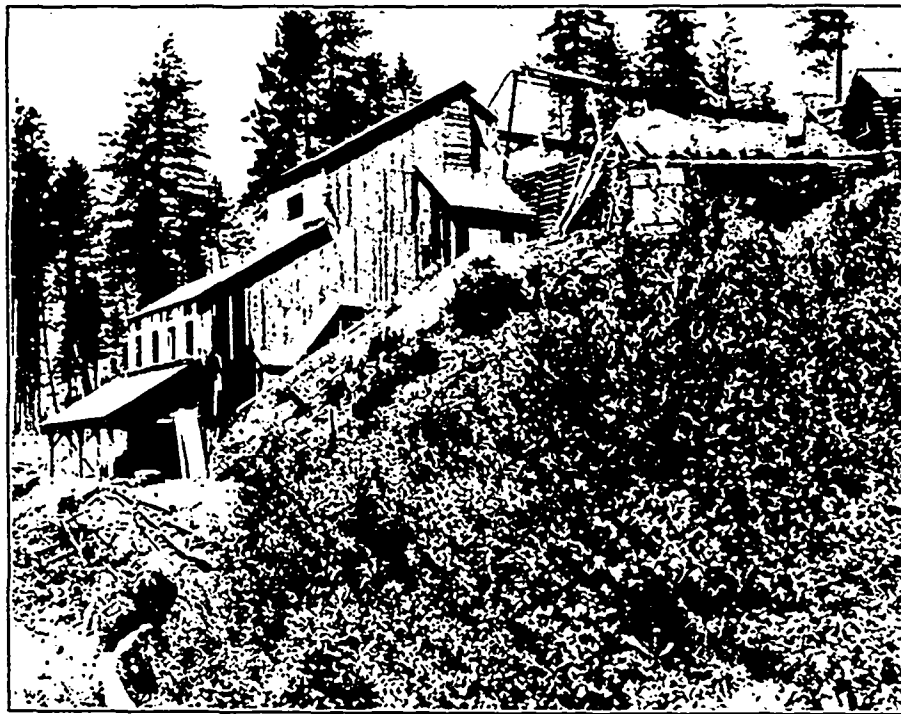
THE VELVET MILL.

(By Alfred W. Dyer.)

THE Velvet mine, with which has been recently incorporated the adjoining property, the Portland, is one of the hardest problems that have confronted the men who, at Rossland, are trying to determine the best method of treating the low-grade ore bodies found in such wide areas over that district. It is situated upon Sophie Mountain, almost upon the International Boundary Line, between Rossland and Northport. But the railway runs along the valley of Little Sheep Creek on the eastern face of the mountain, whereas the Velvet and most of the other Sophie Mountain properties, overlook Big Sheep Creek on

erty, as only its richest ore bodies could pay such expenses. One such period of activity terminated last season when, to make matters worse, it was reported that the higher-grade ore bodies, found upon the Portland, on which the life of the properties as shipping mines depended, had pinched out at depth.

Early last spring the directors of the mine, acting upon a report made last year by Mr. William Thompson of the Kootenay Mines, ordered a resumption of work upon the plan proposed. This plan was to concentrate the silicious ore bodies by water or oil concentration and to attempt pyritic smelting of the higher-grade rock, in which latter material assistance would be given by the concentrates.



Velvet-Portland Mill, on Sophie Mountain, near Rossland.

its western face. To the south the two creeks unite, but south of the Boundary Line. A waggon road, more than twelve miles long, connects the mine with the branch of the Great Northern known as the Red Mountain Railway. A waggon road which would be entirely within British territory, twenty miles long, has been proposed and has actually been surveyed between the Velvet and Rossland, but the Provincial Government has so far not been able to attempt more than this survey; hence the cost of all supplies brought to the mine has been enormously increased, owing to these serious difficulties of transport.

During the past few years the mine has had several periods of activity and a fair amount of ore has been shipped, but the long haul has told against the prop-

Towards the middle of the month of July of this year Manager Thompson had the mill completed and running, and it is claimed that the results exceed all expectations. The mill was largely experimental, being the first in Rossland where classification by water preceded concentration and to this method the management attributes the whole of its success. The plant is by no means a large one as only 50 tons daily can be put through. This was but natural, as the experiment could hardly have justified the expenditure of large capital prior to the event. The success of the mill may, of course, lead to the erection of a larger plant, when other details have been found favourable to this course.

Just now the chief interest is in the mill, and a de-

scription of the method employed may be interesting reading:

The ore enters the highest portion of the mill and immediately passes through a 10-inch by 15 inch Dodge crusher and is there reduced to 1½-inch cubes. Thence it passes to a 7-inch by 10-inch Blake crusher, which further reduces it to a ¾-inch cube.

The dry crushing machinery is run by a 12-inch by 14-inch slide valve steam engine; all drives being independent of the mill proper. This feature is introduced in order to provide a steady driving power for the concentrating tables.

After having been reduced to three-quarter inch cubes as described, the ore passes into a 100-ton storage bin and thence is sent through three sets of steam Tremain stamps, each having a capacity of 25 tons to 40 mesh. The ore is fed into these stamps by automatic feeders and there is crushed, in water, to a suitable mesh. That mesh is of course, yet a matter of experiment. It is reported that excellent results have been obtained from a 20-mesh. In these stamps are placed amalgam plates taking up the free gold which from time to time occurs; also native copper, found occasionally in the ore, drops to the bottom of the mortars.

The pulp now flows by gravity to a series of hydro-metrical classifiers where the heavier particles are separated from the lighter. The next step is to send the separated pulp over two Overstrom tables, one of which is especially designed for the higher or coarser particles and the other for the lighter or finer. The concentrates produced by these tables are sampled, dried and stored for further treatment.

In order to have a check upon the tailings, a Bartlett tables is here provided, over which a portion of the tailings may be sent if these "middlings" should occasionally be found to carry values.

It will be gathered that the main features claimed for the mill are a crushing by stamps, which are fed by water having an upward flow, thus carrying off the lighter portions immediately through the screens and reducing the tendency to slime, and the classification by hydraulic means. This latter feature is novel in Rosslund and is found to work very successfully, as it enables an adjustment of the concentrating tables suitable to the class of material to be handled.

In this particular mill this feature alone is considered to make all the difference between success and failure.

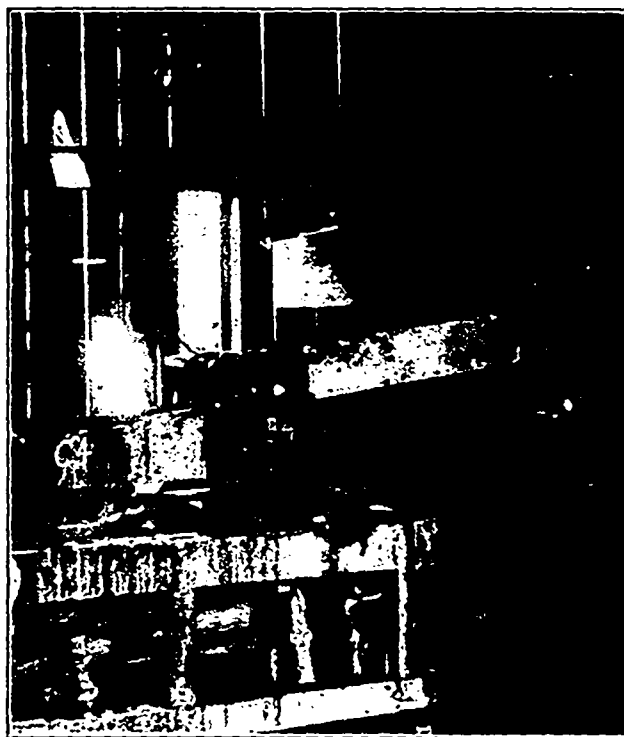
The ore handled thus is of the usual type of Rosslund ore as far as the gangue is concerned but differs in the manner in which the values are contained. The concentrates consist chiefly of iron pyrites mixed with small quantities of chalcopyrites. A general mixture of concentrates produced is found to assay from 1½ to 2½ ozs. in gold, 1 to 3 ozs. in silver and from 4 to 6 per cent. copper.

The pyrrhotite usually accompanying ores mined immediately adjoining Rosslund is entirely absent from

the ores of this property. Generally speaking they are somewhat easier to concentrate than are the usual run of the Rosslund ores, that is to say, so far as they have been experimented with.

As yet the mill has not been long enough in operation to tell what will be the average ratio of concentration. This, however, will likely be found to be about 8 to 1.

The value of the ore treated is about \$7 to \$8 and the percentage saved is close upon 80 per cent. In fact the assays thus far show an even greater percentage. As the tailings thus run but little over a dollar and as a portion is soluble copper, irrecoverable by any known process, there is very little room for the Elmore process, which, however, is experimenting. The use of the Bartlett table goes far to preclude any



Velvet-Portland Mill—Classifiers.

other systematic tailings treatment being found necessary. But as already alluded to the mill result, however successful, is only a portion of the whole scheme.

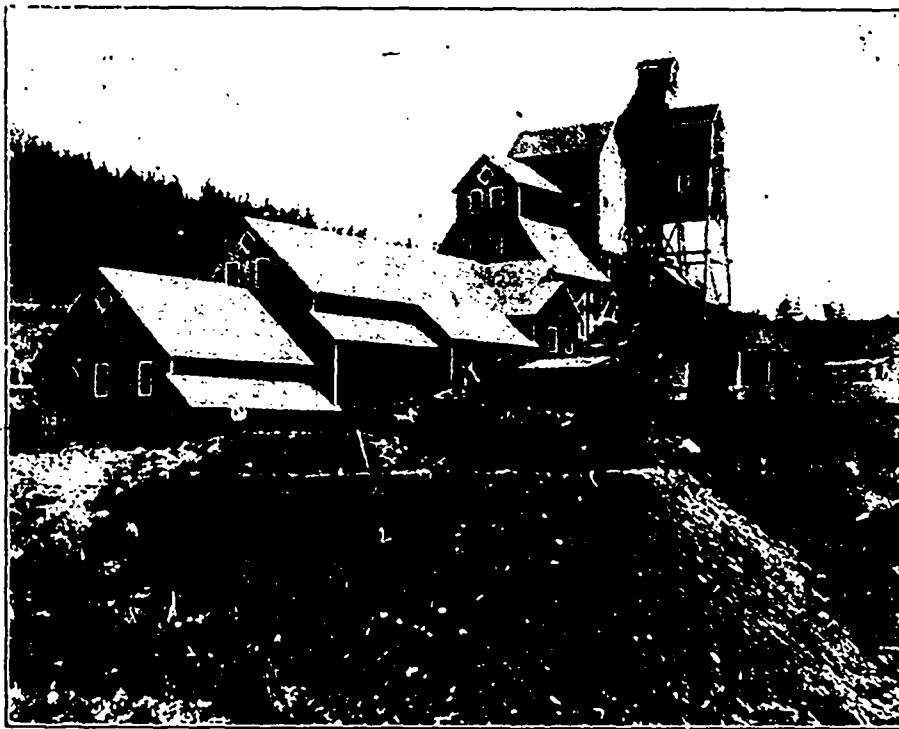
In the development undertaken this spring the vein thought to have pinched out was re-discovered. There are high-grade streaks in the mine which run well over \$50 per ton. There is a large body of ore in the mine running about \$10 to the ton, which, containing much sulphides, is low in silica. These last classes of ore are not concentrating. The idea is to erect a stack and smelt these various bodies together with the concentrates produced from the silicious bodies, using the sulphur as a fuel and the iron and the little lime contained to produce a ferro-silicate slag. This stack is in course of construction and it is calculated that

the final result will be the production of a matte concentrating about 20 to 1, meaning that the cost of freighting and smelting 19-20ths of the ore will be eliminated from the mine charges.

The percentage of coke to be used will not exceed five and it is intended to produce charcoal upon the ground as it is found that this will be cheaper than bringing in coke by waggon. Lime has not been discovered in a usable condition, but this is got over in the manner above indicated. Water there is in plenty on the hillside for the mill and as far as the reduction plant or stack is concerned the mine is making some 150 gallons per minutes, drained through

ment of the White Bear, having duly in mind the returns from the Elmore process as employed upon the Le Roi No. 2, are now completing the erection of a 100-ton plant at the mine. As will be seen from the accompanying cut, the headworks of the property are utilized to run the ore as hoisted into the crushers where it is sufficiently broken to be conveyed to the stamps and go thence over the Wilfley tables through the oil process as described previously in the *Mining Record*.

It is anticipated that the experience gained in the operation of the Elmore mill at the Le Roi No. 2 will be of value to the management of the new mill. No



Elmore Oil Concentrator at White Bear Mine, Rossland.

an adit on the 400-ft. level which will more than suffice for all present needs.

The whole process is as cheap as it is efficacious and its success will no doubt stir up other properties with facilities that are even better to make a like attempt. It is this, together with the novel treatment of the mill, which lends interest to the whole scheme of working.

Mr. Andrew Larson has been placed in charge of the property.

THE NEW ELMORE CONCENTRATOR AT THE WHITE BEAR MINE, ROSSLAND.

DESPITE the various experiments that are being made at the Velvet, War Eagle and Le Roi mines as to water concentration the manage-

more cost will be entailed for crushing, or but slightly more, in the new plant as against its predecessor, as the capacity will be about the same. Instead of the Trent mills stamps will be employed, but whether in a future mill the stamps will always be employed instead of the Trent mills, remains to be determined by experience.

The cost of running the 100-ton plant will not be much larger than for the 50-ton plant set up last autumn, but the production of ore will be twice as large. Again, experience will have taught the management that it is advisable to generally have on hand a large store of oil, coal and supplies, so that there shall supervene no such difficulties in winter as occurred last season.

These new factors in the equation, together with the reduction of the cost of the oil by nearly one-half,

ought to solve the question of whether or not the Elmore process is more than a technical success. If so it is likely that the Le Roi will also adopt this method.

ORIGIN OF OIL OR GAS, AND THE GEOLOGICAL CONDITIONS UNDER WHICH THEY ARE FOUND.*

FEW questions relating to Economic Geology are more generally asked than that of the origin of oil and gas, and few are more difficult to answer. In fact it is impossible to state with certainty at the present time how these fuels have been formed. Nevertheless, because of the great interest, the subject will be reviewed here.

Petroleum and natural gas are intimately associated. Wherever oil is secured there gas is found, and as is well known, it is the expansive force of the gas which produces flowing wells. As the gas escapes, the force weakens and the well ceases flowing. Generally where natural gas is found in large quantity oil also exists or is near. This is often well illustrated on anticlines, gas being found at or near the summit of the arch and oil farther down the slope. However, oil is not always associated with gas. Thus the great gas fields of Central Ohio are not associated directly or indirectly with oil. Examples might be cited from other parts of Ohio, also from additional States, and so it may be regarded as certain that petroleum is not a necessary accompaniment of natural gas.

Considered from the chemical standpoint oil and gas are closely related, and where the oil has an unusual composition the gas of the same field is likely to be characterized in a similar manner. An illustration of this is found in the oil and gas of the Trenton Limestone** fields where the sulphur, which is so striking a constituent of the oil, is found in the gas also. In those fields where sulphur is not found in the oil it has not been reported in the gas.

From the intimate association of oil and gas in nature and from their chemical relations it seems certain that both have been derived from the same substances and probably in the same general manner. For these reasons the two will be considered together here.

Of the theories propounded that have received serious consideration, two classes may be recognized:—

First those which assign to these products an inorganic origin. These maintain that oil and gas have been produced by the reactions of inorganic sub-

stances. In general it may be stated that this class of theories has been advocated by chemists and at the present time some eminent scholars contend that this is the most reasonable view to take of the subject. This class might be called the chemical.

The second class of theories assigns an organic origin. That is, that oil and gas have been formed in some manner from organic matter, either animal or vegetable or both. As to how the changes have been produced, however, there is much difference of opinion. While this class has been advanced by some chemists, it has been most strongly advocated by geologists, and might well be called the geological.

THE INORGANIC OR CHEMICAL THEORIES.

After quoting a number of theories of distinguished chemists, Professor Bownocker continues: The theories given appear to require one element in common, namely, great heat. Now this can be secured, so far as gas and oil are concerned, in only two ways, (1) by reaching great depths in the earth's interior or (2) by intrusion of molten rock. The great oil fields of this country lie in the Mississippi basin, a region that has been singularly free from intrusions of molten material. These remarks apply equally well to the recently-discovered pools along the Gulf of Mexico. It follows naturally from this that the great supplies of petroleum in the United States cannot have been produced through the agency of heat derived from intrusions of highly heated material.

The other alternative, namely, that the heat was obtained at great depths, is equally inadmissible. Not that high temperatures do not exist at such places, for all admit that such are there found. However, the great pools of oil and gas lie near the surface where the temperature is not more than 60 degrees for each 50 or 60 feet of descent. In fact important pools have been found at depths of 100 feet or even less, and it is apparent to all that the temperature at such places must be little in excess of the surface average. The evidence of the absence of heat in the oil or gas-bearing rocks in earlier times is as positive as the present. Heat is one of the principal factors in metamorphism, and if any such temperature as the inorganic theories demand had existed, the rocks themselves would furnish unmistakable evidence. In Ohio alone probably 50,000 wells have been sunk to depths approximating 1,000 feet; many have reached 1,500 feet; a smaller number 2,500 feet, and occasionally a well has exceeded 3,000 feet. Now the drillings from these are a unit in denying any evidence of high temperatures. In fact fragments brought up from the greatest depths show no more evidence of heat than do those 100 feet or less below the surface.

From these lines of testimony it is safe to say that the rocks which now contain the oil and gas have never been highly heated. There remains but one alternative for the advocates of this class of theories, and that is that oil and gas were produced at great depths and have gradually risen from that place to the position which they now occupy. To this there appears to the geologist an insuperable difficulty, for

*Abstract from Chapter V. of Fourth Series, Bulletin No. 1, Geological Survey of Ohio, "The Occurrence and Exploration of Petroleum and Natural Gas in Ohio," by John Adams Bownocker, D.Sc., Professor of Inorganic Geology, Ohio State University, and Assistant State Geologist.

**The Trenton Limestone, the first member of the great division known as the Ordovician, is not only the most important source of oil in Ohio, but probably it is not excelled by any single formation in the world. It forms the floor, so to speak, of the entire State, being found wherever the drill penetrates to a sufficient depth.

lying between these deep-seated and hence highly-heated rocks and those which now contain oil and gas are, in many places at least, great thicknesses of compact shales and other fine-grained rocks which are impervious. This is well illustrated in south-western Ohio, where the Berea Grit***, and of course the rocks lying above it, and which contain important quantities of oil or gas, have lying below a great mass of fine-grained shales, ranging in thickness from 805 feet to probably 3,000 feet. If the oil and gas could have risen from below, passing through this great depth of shales, they would have continued their ascent and been wasted at the surface long before man appeared. This specific example can be duplicated in some form in every great oil or gas field. Fortunately parts of the geological scale are impervious, for otherwise oil or gas in large quantities could not exist.

If the inorganic or chemical theory were true it would be reasonable to expect petroleum and natural gas in igneous rocks, since they have been highly heated, and hence in a condition favourable for the production of these fuels. Experience, however, has shown that neither oil nor gas is found in rocks of this kind. So far as the writer knows there is no exception to this statement.

THE ORGANIC OR GEOLOGICAL THEORIES.

These theories have only one point in common; all assign organic matter as the origin of petroleum and natural gas. Some contend that these products have been derived wholly from animal matter, others entirely from vegetable matter, and others still from both. There is likewise no general agreement as to the method by which the change has been produced. Another point of difference still is the position which the products now have when compared to that which the organic matter once occupied. Some regard them as identical; that is, the petroleum and natural gas now occupy the same rocks that the organic matter from which the fuels in question were formed once occupied, while others contend that the organic matter originally occupied a lower position than the resultant products now do. A third view adopts each in part; that is, one theory is correct when applied to some fields but not when applied to others.

If oil and gas have been produced from organic matter then these products or others closely related ought to be secured artificially. Much experimenting has been done along this line and with considerable success; products very closely resembling petroleum have been secured artificially from both animal and vegetable matter. But how have these products been produced in nature from organic matter? This, from the nature of the problem, is not susceptible of proof. However, there is perhaps greater uniformity of opinion than in the inorganic theories. Peckham regards petroleum to have been produced by the distillation

***Berea Grit (Lower Carboniferous) is the most extensive sandstone of the State of Ohio. Its area above and below drainage is about 15,000 square miles, or more than one-third of the area of the State.

of animal and plant remains at low temperatures. The great reservoirs in certain States he mentions were, he thought, produced in rocks lying much below those which now contain them. Phillips assigns a vegetable origin to petroleum, claiming that the change has taken place under water, and hence in the absence of air. The first changes were relatively rapid, and the later one, which is directly responsible for the petroleum, much slower. Newberry, in an elaborate theory to explain the origin of oil and gas in the Appalachian field, makes the source the plant remains in the great shales lying in the Lower Carboniferous and Upper Devonian formations, the products rising to the horizon where now found. Dr. Orton****, who has written elaborately on the subject, considered both petroleum and natural gas to have been derived from organic matter, animals in some cases, plants in others. Dr. C. B. Morrey, Professor of Bacteriology in the Ohio State University, has furnished a radically different theory, namely, that petroleum of the Pennsylvania type and gas in similar situations were found in the mud of which shales were composed, from the time the mud was first deposited and by the decomposing action of bacteria on the organic matter therein, the decomposition continuing until all the organic matter was broken up into compounds no longer capable of being attacked—the hydro-carbons among others—or until the bacteria were killed by an accumulation of their own products; or the decomposition could also have been stopped by a drying out of the shales, the presence of a certain amount of water being necessary for bacterial growth.

But were the fuels in question derived from organic matter which was once imbedded in the same rocks that now contain the oil and gas, or were the latter formed from organic matter which was deposited originally in rocks lying beneath those now containing these substances? There are two different views on this matter, but the majority seems to favour the latter one. Dr. Orton regarded the oil and gas in the Trenton Limestone to have been formed from animal matter which was entombed in that formation. However, when the remaining oil and gas rocks are examined, the conclusions reached are not so positive. Thus the great gas wells in the central part of the State are obtained in a thin stratum of sandstone of Clinton age.

GEOLOGICAL CONDITIONS UNDER WHICH OIL AND GAS ARE FOUND.

There are three conditions which have been strongly advocated by geologists:

1. A porous rock to contain the oil or gas.
2. An impervious cover.
3. Geological structure of the rocks which will permit the accumulation of oil and gas from relatively large areas into smaller ones.

All agree as to the necessity of a reservoir-rock. The one essential of this is porosity. Very fine

****See Geology of Ohio, Vol. VI., Economic Geology.

grained rocks cannot, therefore, serve this purpose, and for this reason shales are not important oil or gas-containing rocks. In Ohio three types are found—limestones, sandstones and conglomerates. The limestones contain the immense repositories in the north-western part of the State, but are not productive in other fields in Ohio. Analyses show the rocks to be strongly magnesian and much weight has been placed on this feature, since limestones of this type are notably porous when compared with those of the ordinary or calcareous type.

Recent developments in Texas, however, show that calcareous limestones may serve as a reservoir for oil. Thus, according to an analysis, the oil rock in the great Beaumont field contains over 97 per cent. carbonate of lime. When it is considered that this rock has yielded by far the greatest wells yet drilled in the United States, it is apparent that ordinary limestone may serve as efficiently as that of the magnesian type.

Sandstone is the most common reservoir rock, and perhaps the Berea Grit is the best illustration of this. The rock is composed of moderate-sized grains of silica. However, it appears compact, and the quantity of oil which it contains often seems out of proportion to the porosity of the rock. In fact it is hard to believe that this formation ever contained the great volume of oil that has been taken from it in places. This appears all the more remarkable when it is recalled that the so-called pay-streak usually composes a small part only of the rock. Sands of this character do not yield great wells, but their life as a rule is long. These characters are certainly in harmony with the porosity of the rocks. The Berea is the finest-grained of the important oil or gas sands of the State.

Sandstones grade imperceptibly into conglomerates, and hence it is not easy to say when one leaves off and the other begins. Many of the so-called conglomerates of Ohio vary in texture rapidly, changing in a short distance to a sandstone. Some of the sands are conglomeritic in places, but more commonly they are coarse sandstones. They make excellent reservoir rocks, and the wells sometimes have large initial productions. The decline, however, is almost invariably more rapid than in the Berea. The production is often long maintained.

Shales are not important sources of either oil or gas, though small quantities of both are often found in them. In the coarser grades of these rocks oil and gas may occupy the spaces between the grains, but in the finer grades the fuels in question probably lie between the layers of the rock rather than between the component particles.

The necessity of an impervious cover is apparent. Without it the gas would have risen to the surface and been lost ages ago, and the more volatile parts at least of the oil would have met a similar fate. Not uncommonly the rock is very compact at the top forming the "cap" of the driller. This may serve to retain the oil and gas below. Generally, however, a bed of shales lies above the formation, and serves

to prevent the ascent of the fluids. A thin bed of fine clay also would serve admirably to seal in the oil and gas.

The third geological condition is structural, and is commonly known as the anticline or terrace. This permits the oil and gas of a relatively large area to accumulate in a much smaller one. This theory is very generally accepted by geologists and equally so by laymen. In many cases important reservoirs have been located by applying the principle—in Eastern Ohio, West Virginia and Pennsylvania. In the north-western part of Ohio the rocks form a broad arch, dipping to the north-west on one side and to the south-east on the other. The arch contains minor irregularities, such as the well-known Findlay break. It was on or near this break that many of the largest gas wells were found, and in general it may be stated that the richest oil territory has been found where the Trenton rock lies highest.

It cannot be said that all oil or gas fields in Ohio are associated with anticlines or terraces. Several well-known gas and oil fields have not as yet been demonstrated to lie on these structures. However, the reverse has not been conclusively demonstrated, and the fields in question may still fall in with the anticline or terrace theory. The great reservoir at Beaumont, Texas, also appears to stand in opposition to this theory.

INTERNATIONAL COMPANY'S COAL MINE AT COLEMAN, ALBERTA.

(By E. Jacobs.)

GOOD progress is being made at the International Coal & Coke Company's colliery at Coleman, Alberta, both with the development of the coal mines and the construction of the surface works.

The coal lands acquired by this company are those known as Paulson and Newport's, situated between four and five miles west of the town of Blairmore. They extend about seven miles north and south on the strike of the coal measures, and have a width of one mile. The greater length of these coal lands is south of the railway, which, following the course of the Crow's Nest or Old Man River, runs close to where the coal seams pass under the wash in the valley, or rather have been eroded away, only to re-appear in the hills to the northward. So advantageously are these lands situated that the railway passes within 200 yards of the main entry to the mine now having chief attention as development proceeds.

Of the nine seams of coal stated to be known to occur on the company's lands only five have as yet been prospected. Three have been opened near the railway. These seams run in a northerly and southerly direction through the property and are reported as being regular and consistent, and in good condition wherever tested. They have a westerly dip and, with one exception, are all east of and under that now known as No. 2 and on which for the present most of the development work is being done. No. 1, the

most westerly seam yet opened here, is about 5 feet in thickness; No. 2 is 14 feet; No. 3, which is opened two miles away to the southward, is 17 feet; No. 4 is 11 feet and No. 5 about 7 feet. The main entry is on No. 2 seam, and the heading is now in about 2,000 feet. The entry is 10 feet by 14 feet. About 1,000 feet in, a cross-cut tunnel in rock has been driven 790 feet to the eastward, crossing from one seam to another. The intention is to make this easterly road the main haulage way, and in it ample provision is also made for ventilation. The mine is being opened on the pillar and stall system, with barrier pillars. The workings will be ventilated by a Capell fan 16 feet in diameter. The main system of haulage will be compressed air. Meanwhile horses or mules are being used. The entries on the coal have opened up a large area of ground and mining will be commenced

2 contains about 30 per cent. volatile combustible matter, 60 per cent. fixed carbon and 10 per cent. ash. The coking seam is lower in volatile, not more than 24 to 25 per cent., with fixed carbon 64 to 70 per cent., only 1 to 2 per cent. moisture, and practically no sulphur. It makes a firm coke of generally good quality.

The haul-up chains on the incline to the tippie, which is being built alongside the Crow's Nest railway, are arranged to run at 60 feet per minute, raising the cars at the rate of two and a half per minute. If increased to the full capacity of four cars per minute the rate will be 100 feet per minute. The blocks on the chain are 24 feet apart. The storage bins at the tippie have a present holding capacity of about 1,000 tons; enlargement will be made as required. The coal screening and loading apparatus



Crow's Nest Mountain, near Coleman.

as soon as the fan is in operation. At the middle of August entries on the seams totalled 5,300 feet.

The coal being taken out in development is an excellent steam coal, probably the best produced in the district. The output is about 150 tons a day, which is loaded on railway cars, the Canadian Pacific Railway Company taking all the mine produces at present. As soon as the fan is running and mining commenced the output will be at least 400 tons daily, the mine already being in a position to easily produce that quantity. This coal is quite free from impurities, clean coal the whole 12 or 14 feet from roof to floor. No. 5 seam had been opened and the heading was in 200 feet when the mine was visited by the writer, but further development was then being deferred until coke-making should be commenced, so as to avoid unnecessary handling of the coal. This is the best coking seam, so far as yet determined, the company possesses. Analyses of these coals showed that No.

has shaking screens and a horizontal picking belt, the latter for dry cleaning, no washing being needed.

There is practically none of the plant yet completed, but all under construction. With the exception of one engine and generator and the compressor, all the machinery has been received at the colliery and is being installed. The installation of the fan and the machinery in the power house is well forward; the boilers are all set and the boiler house completed. The tippie is about half finished, and the railway tracks are laid. The preliminary construction work included the grading and laying of about four miles of standard-gauge track for shipping facilities for coal and coke, etc., and the erection of coke ovens. Of the first battery of 104 ovens 50 have been completed and fired, and the remaining 54 will be finished this month. It is intended to increase the number of ovens to 400 later. Comfortable bunk and boarding houses have been erected, also a commodious building;

for the company's general offices. Residences for the officials have been built as well.

Altogether there are about 250 men employed by the International Company, this number including both those engaged on construction and those working in the mine. Mr. H. N. Galer is vice-president and general manager of the company. Mr. Edward E. Reynolds, C.E. and M.E., who resigned his office of mine inspector of the Seventh District, Pennsylvania, to accept the position of general superintendent for the company, arrived at Coleman early last January, since when the opening up of the mine and the construction of the surface works have proceeded under his direction. No other coal mine in the Blairmore-Frank district has commenced operations under more favourable conditions, so that an excellent beginning has been made, and the fact that the opening of the mine and the general equipment of the colliery have been entrusted to such an experienced and fully competent superintendent augurs well for this enterprise having a prosperous future, these favourable



"The Loop," on Crow's Nest Railway, between Michel and Coleman.

circumstances being associated with the possession by the company of a property that promises to yield abundantly a product of excellent quality.

There are three small towns in the vicinity of the coal mines of the Blairmore-Frank district, viz., Frank, Blairmore and Coleman, the last named planned and established by the International Company. When Coleman was visited by the writer it was seen that the valley there has a width of from a quarter to half a mile, with bench lands and hills rising from it both north and south of the Crow's Nest railway. The town is just across the railway track from the main entry to the mine, the bottom land south of the railway having all been reserved for colliery purposes. Although not yet twelve months old there are some 20 places of business completed and occupied and more building. One hotel has 40 odd rooms all told and it is modern in its appointments. Other prominent buildings—company's offices, bank, stores, etc., are commodious and well-finished, and the young town, which has a school, a church with resident

clergyman, resident surgeon, railway, telegraph and postal facilities, and is a station for the North-West Mounted Police, has a generally flourishing appearance. The other towns are older, but the indications are that the energy and enterprise of the International Coal & Coke Company will make Coleman the most important and populous centre in south-western Alberta.

GOLD-SAVING ON DREDGES IN NEW ZEALAND.

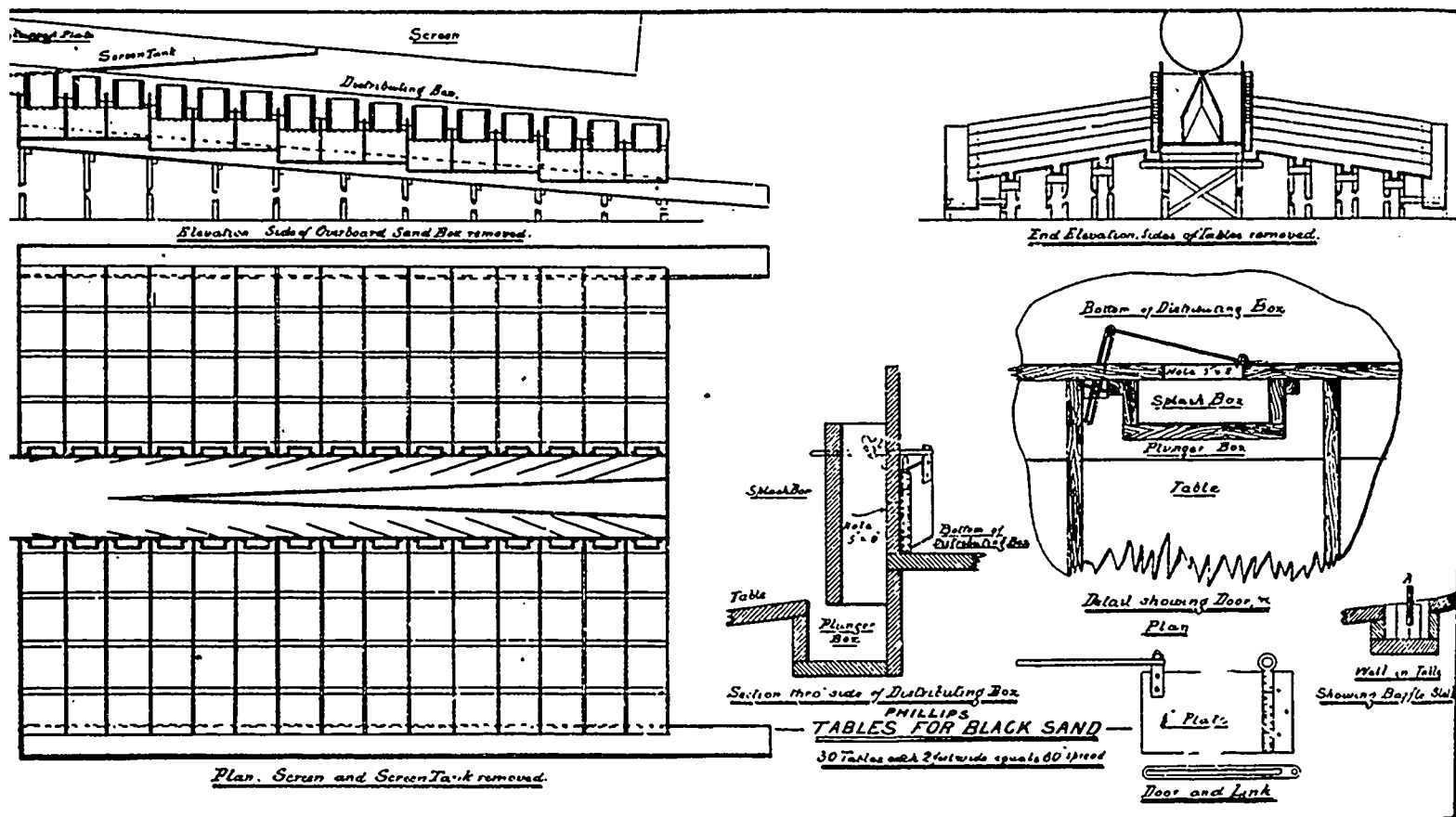
IT is interesting to note what improvements have actually been made in gold-saving appliances. The old-fashioned method of making the screen perforations discharge directly upon the head of a set of inclined tables or strakes covered with matting, on each of which is laid a sheet of expanded metal, still prevails on the Otago goldfields. With few exceptions, no attempt has been made to regulate the quantity of pulp passing over the different divisions in the tables, nor does the quantity of water lifted and utilised for washing the gravels bear any proportional relation to the normal quantity of sand passing through the perforations of the screen.

About two-thirds of the dredging ground on the West Coast consists of creek and valley deposits, and the balance of littoral deposits. The gold found in the littoral deposits, both recent and alluvial, is in a fine state of division, and as it occurs with large quantities of magnetite, ilmenite, garnet, and other minerals of high specific gravity, has long exercised the ingenuity of miners and others to obtain a fair extraction when dealt with in quantities. The effect has been a tendency not only to extend the spread of tables, but also to provide distributors and mixing boxes, so that the pulps passing over each foot in width of the tables shall consist approximately of definite proportions of mineral matter and water. The first step in the evolution of the modern table consisted of the addition to the ordinary tables of distributors and mixing-wells, the latter being generally known as "boil-boxes." The latest improvements suggested by experience are embodied in Cowan's Pactolus tables and Phillips's black-sand tables. The former are in use on dredges where only a limited deck-space is available, and give every satisfaction. The tables are superimposed one over the other, thus making a given area provide space for double the spread. The upper spread of tables is fed from one side of the distributing-box, and the lower from the other side. The method of distributing by fixed partitions in the distributing-box is not so good as with Phillips's doors, which are provided with quadrants and thumb-screws, and are adjustable. As the deck of a dredge and, consequently, the distributing-box is seldom absolutely level in cross-section for any length of time when the dredge is working, there must always be a slight variation between the quantity of pulp

*Abstract from a paper in Papers and Reports relating to Minerals and Mining, New Zealand, by J. P. Smith, M.A., In M. E., Dunedin, N.Z.

discharged from one side of the box and the other. Phillips's tables are working on a dredge dealing with a littoral deposit of sand and shingle. The gold is very finely divided, and associated with large quantities of black iron-sand (magnetite and ilmenite). The sand is saved with the gold, and afterwards separated by amalgamation. If any loss of gold occurs over either Cowan's or Phillips's tables it is not due to any want of efficiency of the tables, but from the failure of the pump to lift the quantity of water required to keep the strakes free from gravel, and this will always be liable to occur so long as a separate engine is not provided to drive the pump alone. As the

it, which for a time largely increases the quantity of solid matter passing over the tables. When dredging through ground of this loose nature the tendency is for the face to fall in freely to the buckets, with the result that the whole of the buckets come up full and sometimes piled up. Now, material of this description packs closer in the buckets, and consequently the weight of the ladder is largely increased. On a machine where the engine under normal conditions is working at its maximum efficiency, which is often the case, the additional load at once reduces the speed. The lifting capacity of a centrifugal pump varies with the number of revolutions it makes within certain



Gold Dredging in New Zealand.—Table for Saving Fine Gold.

quantity of sand passed over the tables is governed by the size of the perforations in the screen, and there are no other means by which it can be regulated, there will always be a varying quantity of solid matter in the pulp. No two cubic yards of gravel in a working face can be relied upon to contain equal quantities of fine material of less than 1-inch in diameter, the size of the largest perforations in many screens. Where the ground consists of alternate layers of sand and shingle, the quantity of fine material varies with nearly every bucket discharged. In creek beds and flats there are occasional deposits of fine drift resting directly on the auriferous wash and lifted with

limits, so that the effect of the reduced speed is a diminished supply of water just at the moment when the largest quantity of solid matter is passing over the tables. If gold is lost over the Pactolus or Phillips tables, it is under these abnormal but frequently occurring conditions, and no tables will ever be designed to prevent this loss until the pump is driven by a separate engine instead of by a belt from the main engine.

As the difference in first cost between the old style of tables and those fitted with distributors is merely nominal, the question of expense can never be pleaded as an excuse for shortsighted conservatism.

ZINC AT QUATSINO SOUND.

Thanks to the courtesy of the Provincial Department of Mines the MINING RECORD was enabled to publish in its June issue an illustration of some surface workings on the Peerless mineral claim, situate in the neighborhood of Teta River, a small stream flowing into the South-East Arm of Quatsino Sound, on the North-West Coast of Vancouver Island. This claim, which is on the western side of the Arm, a few miles from Yreka, was visited last year by the Provincial Assayer, Mr. H. Carmichael, who in his report on the Quatsino district thus referred to it: "The Peerless mineral claim is situated to the east of the June group, on Murray Creek, on the western end of the range separating Alice Lake from Victoria Lake. Link Creek flows round the north-western base of the mountain from Victoria to Alice Lake. After crossing Link Creek from the June group, and at the eastern end of a slight ridge, open quarry work has exposed an ore body 30 feet wide of nearly solid zinc-blende mixed with a little quartz vein matter. The quarry shows a face of from 9 to 10 feet high. Some prospect holes have been sunk on the ridge 200 feet to the west of the quarry, the mineral at this point being principally arsenical iron in a quartz, with some blende.

From information published last month by the *Victoria Times* it would appear probable that the zinc resources of the Quatsino Sound district will shortly be exploited. Said the *Times*:—

"That there is an extensive body of zinc ore in the vicinity of Quatsino Sound, and furthermore that it is attracting the attention of United States capital, are facts that have come to light through the visit to the northern part of the Island of Mr. Thos. Jones, representative of the Lanyon Zinc Company of Iola, Kansas.

"Mr. Jones has just returned from his visit of inspection, which occupied twenty days, and is preparing a report for headquarters. He found in the Peerless group, which adjoins the June group on the southeast arm of Quatsino Sound, and the Minerva fraction on the other side, some promising properties, with the best showings he has yet seen. He brought down a number of samples, some of which run fifty per cent. or thereabouts in zinc.

"He was surprised that they had not been more exclusively developed, and from what he said it is quite likely that his company will exploit the zinc resources there to a considerable degree.

"Mr. Jones was quite reticent regarding the plans of his company respecting the Quatsino properties, but his visit to them is fraught with plain significance. He expects to return before very long and make a more exhaustive examination."

THE DETERMINATION OF SILVER IN THE SULPHIDE ORES AND CONCENTRATES OF THE SLOCAN.

A COMPARISON OF POT AND SCORIFICATION ASSAYS.*

(By D. Lay.)

It may perhaps be stated that the output of the Slocan will consist of ores and concentrates containing on an average upwards of 150 ozs. of silver per ton, and varying in composition from comparatively pure lead sulphide to complex sulphides of lead, zinc, iron, antimony and copper.

The question of the best method to adopt, in assaying material of this character for silver, is probably one upon which considerable difference of opinion exists among those most competent to judge. Some will find that they obtain the best results by scorification, while others will have resource to some form of pot assay.

Very briefly, the essential factors of success in the process of scorification are:—

- (1.) An "opening up" stage of very *short* duration, necessitating a high initial temperature.
- (2.) A period of oxidation, of comparatively *long* duration, at a low temperature; it being imperative that the temperature be lowered *immediately* the charges have "opened up."
- (3.) A final raising of temperature after the charges have closed in, to ensure perfect liquidity, and therefore perfect separation of lead and slag.

The presence of some elements in the ore under determination may render adherence to the above-stated conditions difficult, and may, therefore, seriously detract from the accuracy of the process. It may be said that the conditions adverse to scorification are:—

- (1.) The presence of elements in the ore which *prolong* the "opening up" stage, and therefore cause a loss of silver.
- (2.) The presence of volatile elements, which promote the silver loss throughout the process.

The products of the Slocan in the majority of cases contain these objectionable elements, which tend to render the scorification assay inaccurate; consequently it would seem that the adoption of the pot assay is fully warranted, at any rate in these cases. Moreover, the pot assay presents certain advantages over scorification, apart from the question of accuracy, which should still further enhance the value of its adoption, if it be found to yield reliable results. The following consideration might be urged on the score of the pot assay:—

- (1.) It occupies less time:
- (2.) Owing to its being possible to deal with a larger amount of ore in the pot, the silver buttons obtained may be parted for gold, and

*Transactions of the British Columbia Institute of Assayers

thus the determination of the latter may be carried out side by side with that of the silver.

- (3.) The pot assay does not require so much attention as the scorification and may be successfully accomplished when the material at hand, in the shape of furnaces, etc., is not such as would render a good scorification possible.
- (4.) The adjustment of the charge, according to the requirements of the ore, can be more exactly accomplished in the pot.
- (5.) The larger amount of ore taken should yield a fairer sample.

Having, it is hoped, established a hearing for the pot assay, its *modus operandi* may be proceeded with. The question of a preliminary roasting of ores of this class cannot be considered, as, apart from the time that operation occupies, serious losses of precious metal, both chemical and mechanical, may occur. Neither must desulphurization by metallic iron be attempted if accuracy be desired. The sulphides must therefore be oxidized by litharge alone, or by litharge used in conjunction with nitre.

It will be generally conceded that in the pot assay of ores of this type, apart from a proper adjustment of the charge with regard to acid and base, the following factors are of the highest importance:—

- (1.) The *purity* of the collecting medium, *i.e.*, the lead reduced. It is essential that a pure button of lead be obtained.
- (2.) The *weight* of the collecting medium. The weight of the lead button should be adequate and not less than 20 grammes. Doubtless differences of opinion will exist as to the term "adequate."
- (3.) The *nature* of the slag.
 - (a.) It should contain all the impurities (present in the ore) in a form having no affinity for silver.
 - (b.) It should be free from the peroxides of the heavy metals.
 - (c.) It should contain no sulphides.
 - (d.) Excess of litharge should be one of its most prominent characteristics.

Probably the last is the *sine qua non* of assaying by pot assay *all* ores for gold and silver, it being impossible for litharge and a sulphide to co-exist as such at the temperature of the operation.

The common practice on the part of the adherents of the pot assay for silver in sulphide ores is to take:

Either 1-10 A.T. ore, adding a certain amount of carbon, in the presence of excess of litharge, to produce the requisite size of lead button:

Or 2-10 A.T. ore, which amount of sulphides will usually reduce sufficient lead without any addition of carbon. In some cases a small amount of nitre may be necessary. As in the former method, excess of litharge is maintained in the charge.

In the experience of the writer, these methods have been found to yield results rather *lower* than those obtained by scorification. Doubtless there may be others whose experience leads to a different conclusion. The practice followed by the writer is to take $\frac{1}{2}$ A.T. of ore, preventing excessive reduction of lead by addition of (usually) a large amount of nitre, and producing a button weighing from 20 to 25 grammes. This method yields results as high, if not higher, than those obtained by scorification, and, moreover, does not entail a separate fusion, if a gold determination is required.

Whatever mode of pot assay be followed, there is involved a knowledge of the reducing power of the ore under examination, necessitating a short preliminary assay and a knowledge of the oxidizing power of the nitre used. These are not serious objections, however, as a preliminary assay occupies but little time, and frequently mere inspection will determine how much nitre (or carbon) is necessary. Many object to the use of nitre on grounds which are not only inadequate, but also at variance with actual facts. The danger of the pot boiling over, and excessive corrosion of the pots, are reasons urged, among others, in deprecation of the use of nitre. That a properly conducted nitre fusion is not open to the foregoing objections, is a conclusion, which will be arrived at by experience. There are certain facts, however, which must be borne in mind when using nitre for oxidation of sulphides. The oxidation of sulphides by nitre and litharge may take place along several lines, and consequently the amount of lead reduced may not be constant in any two determinations on the same ore using the same amount of nitre in each case, sulphur and many of the metals being capable of more than one simple state of oxidation. Thus in a nitre fusion, we may have any of the following reactions taking place, or two or more may proceed simultaneously, according to conditions:—

- A. Sulphur oxidized to SO_2 and the lower oxide of the metal formed, e.g.—

$$\text{FeS}_2 + 5 \text{PbO} = 2 \text{SO}_2 + 5 \text{Pb} + \text{FeO}.$$
 This reaction occurs in the *absence* of sodium carbonate and in the presence of silica.
- B. Sulphur oxidized to sulphate, and the lower oxide of the metal formed, e.g.—

{	(i) $\text{FeS}_2 + 7 \text{PbO} + 2 \text{Na}_2 \text{CO}_3 = \text{FeO} + 7 \text{Pb} + 2 \text{Na}_2 \text{SO}_4 + 2 \text{CO}_2$
	(ii) $10 \text{FeS}_2 + 35 \text{ from nitre—O}_2 + 20 \text{Na}_2 \text{CO}_3 = 10 \text{FeO} + 20 \text{Na}_2 \text{SO}_4 + 20 \text{CO}_2$
- C. Sulphur oxidized to sulphate and the higher oxide of the metal formed, e.g.—

{	(i) $2 \text{FeS}_2 + 15 \text{PbO} + 4 \text{Na}_2 \text{CO}_3 = \text{Fe}_2 \text{O}_3 + 15 \text{Pb} + 4 \text{Na}_2 \text{SO}_4 + 4 \text{CO}_2$
	(ii) $4 \text{FeS}_2 + 15 \text{ from nitre O}_2 + 8 \text{Na}_2 \text{CO}_3 = 2 \text{Fe}_2 \text{O}_3 + 8 \text{Na}_2 \text{SO}_4 + 8 \text{CO}_2$

The reactions B and C occur in the absence of much silica and in presence of sodium carbonate. Thus it will be seen that the amount of lead reduced is not entirely dependent on the amount of nitre present. It will also be governed by:—

- (1.) The *character of the charge*—apart from the nitre and litharge present—whether acid or base is predominant.
- (2.) The *period of fusion*—whether slow or rapid

In other words, operating on the same ore with the same amount of nitre present, we may get different amounts of lead reduced, according as we vary either the character of the charge or the time of fusion.

In the presence of a sufficiency of sodium carbonate, sulphur, arsenic and antimony will be oxidized to sulphate, arseniate and antimoniate respectively, which will float as a watery liquid on the surface of the slag. From the foregoing it will be seen that too much reliance must not be placed on the preliminary assay as affording exact evidence upon which to calculate the nitre required in the final fusion. Due allowance must be made for differing conditions. Conditions must be such, during fusion, as to form the lower oxide of the metal which will then combine with the silica or borax added to the charge for this purpose.

The practice followed by the writer is to take ½ A. T. ore and to produce a lead button weighing from 20 to 25 grammes and certainly not less than 20 grammes. Sufficient silica is added to form monosilicates with bases present in the ore and sufficient bicarbonate of soda to form sulphate with all sulphur present, and also arseniate and antimoniate with any arsenic and antimony present; also some 15 grammes borax glass and 100 grammes litharge, together with the nitre which has been calculated to produce the requisite size of lead button. The charge having been thoroughly mixed a cover of raw borax is added, which melts extremely rapidly and prevents any loss from spitting, when oxidation of the sulphides takes place. The crucibles are placed in the furnace at a bright red heat, which is maintained only for a few minutes until the covers have thoroughly melted. The temperature is now lowered appreciably in order that the oxidation of the sulphides by the nitre may not be too vigorous. When bubbling has ceased, the temperature is again gradually raised until it approaches that of incipient whiteness at pouring. The total time occupied by fusion should not exceed some 40 minutes. A very slow fusion, at a low temperature, seems to promote the formation of peroxides of the heavy metals, which not only render the slag pasty, but also have an affinity for silver. Too rapid a fusion will likewise be of bad effect. Apart from losses which may occur from spitting, due to too vigorous oxidation of the sulphides by nitre, the sulphides tend to sink before they are thoroughly oxidized, and the button of lead may be sulphury. No undue amount of care is required to obtain by this method most consistent results, which will be found to be rather higher than those obtained by scorification.

The following table gives a comparison of results obtained by pot and scorification on different types of sulphides:

Type of Ores.	BY POT ASSAY.		BY SCORIFICATION	Approximate Composition of Types
	Fusion with Carbon 1-10 A. T. Ore Taken.	Nitre Fusion ½ A. T. Ore Taken.		
A.		108.0	108.2	TYPE A.— Concentrates Pb=18.25 Zn 15.20 Fe 16.20 S 30 As 2 SiO ₂ = 10
		100.2	100.2	
		98.5	97.8	
		109.2	108.6	
		91.6	90.8	
B.		115.4	115.4	TYPE B.— Concentrates Pb 30.35 Zn=10.12 Fe 18 S 30 As=2 SiO ₂ = 6.8
		129.5	129.2	
		136.0	135.2	
	144.6	145.6	145.0	
	125.7	125.8	125.6	
C.		117.6	119.4	TYPE C.—Ores Pb 45.55 Zn=8.10 Fe 9 S=22 SiO ₂ - 7
		269.0	268.5	
		324.6	324.2	
	272.5	274.9	274.5	
	232.5	234.2	234.2	
D.	101.1	103.4	103.1	TYPE D.—Ores High grade galenas containing upwards of 80 Pb.
		142.2	141.5	
		144.4	143.3	

With regard to the foregoing table, it may be said that the procedure adopted, in making the various assays, is that which has already been described. The results are not those of individual assays, but have been most carefully checked.

In conclusion, it is not for a moment insisted that a nitre fusion, as followed by the writer, is the only good way of assaying sulphide ores of the Slocan type for silver. What is claimed for the method is that it is one good way, and, so far as accuracy goes, it certainly stands comparison with scorification.

A PORTABLE ELECTRIC MINING LAMP.

A PAPER presented recently before the British Institution of Mining Engineers described a small portable electric lamp which has been used for some time at the Bruay collieries, Pas-de-Calais. The lamp is known as the Neu-Catrice. It consists of a box of sheet lead containing two accumulator jars made of celluloid or semi-plastic india rubber. Each jar contains one positive and two negative plates, the two giving a mean voltage of 3.9, sufficient to supply a small incandescent lamp of about one candle-power for fifteen consecutive hours. The lamp is mounted on top of the lead case and is protected by a glass globe, one half of which is coated with a semi-translucent white varnish, which acts as a reflector and allows a small amount of light to be

diffused backward. The lamp is carried by means of a hook attached to three vertical rods which partially protect the globe. Two sizes of this lamp are made—one weighing three pounds, fourteen ounces, giving 0.8 candle-power for eleven hours, the other weighing five pounds and giving one candle-power for fifteen hours. The dimensions of the smaller lamp are ten inches high and two and three-eighths inches square, and of the larger, ten inches high and three inches square. The lamp takes less than three and one-half watts per candle-power and lasts for 500 hours. It is charged at the rate of one ampere for twelve hours. After being fully charged it is partially discharged through a thirty-two-candle-power lamp, in order that the high initial voltage of the cells may not injure the small lamp. Five hundred and four of these lamps are in daily use at the mine mentioned above. About ninety-seven per cent. are kept in regular use, the others being put aside for minor defects. The cost of maintenance is said to be one cent per day. The lamp is considered absolutely safe in gaseous atmospheres, and is very reliable.

ASSOCIATED SILVER-LEAD MINES OF BRITISH COLUMBIA.

THE Associated Silver-Lead Mines of British Columbia held its annual meeting at Sandon on August 16. From reports of the meeting published in Slocan newspapers it is gathered that there was a good attendance at the meeting, all the leading silver-lead shippers having been represented.

Officers and executive committee for the ensuing year were elected as follows:

President, Mr. Alfred C. Garde; vice-presidents, Messrs. James Cronin, W. S. Drewry, W. S. Jenkins, William Hunter and George Alexander; executive committee, Messrs. John L. Retallack, Geo. D. Potter, Norman Carmichael, Louis Pratt, W.E. Zwickey, H. Giegerich and N. J. Cavanaugh; treasurer, Mr. Oscar V. White; secretary, Mr. N. J. Cavanaugh.

The retiring president made an extended report on what the association had accomplished for the mining industry of the Kootenays, touching on the revival in the lead mining industry and, as a consequence, busy silver-lead mines and smelters in British Columbia. He spoke of the amicable arrangement and era of good feeling existing between the smelters and the mines: the appropriation made by the Dominion Government in aid of the zinc mining industry, and other matters of importance, all of which have been accomplished by representations made through the Associated Silver-Lead Mines.

THE AMERICAN INSTITUTE OF MINING ENGINEERS.

(By Wm. M. Brewer.)

ALTHOUGH this Institute was organized in 1871 and to-day has a total membership of nearly 3,500, yet the general public in British Columbia probably know but comparatively little with re-

gard to it, its objects and its influence over the mining industry, not only in the United States but throughout the entire continent of North and South America.

The fact that among its members, in addition to the mining engineers, geologists, metallurgists and mining operators of the United States, there is included a large proportion of the leading mining engineers, geologists, metallurgists and mining operators of Canada, Newfoundland, Mexico, Central and South America, Cuba, Great Britain and continental countries of Europe, Africa, India, Australasia, the Malay Peninsula, China, Japan and Russian Asia, really makes the organization international in its character and demonstrates the important bearing and influence the Institute exerts over the mining industry of the world.

The papers appearing in its transactions, which are published from time to time, are recognized as among the most valuable contributions given to the literature of the mining and metallurgical industries. Many of these papers are from pens of such distinguished men as Franz Posepny, Rositer W. Raymond, Clarence King, Richard P. Rothwell, Samuel F. Emmons, Charles R. Van Hise and others whose opinions with regard to mining, geology and metallurgy are recognized by all mining men as being some of the most valuable authorities of the present time.

The objects of this Institute are to promote the arts and sciences connected with the economical production of the useful minerals and metals, and the welfare of those employed in these industries, by means of meetings for social intercourse and the reading and discussion of professional papers, and through the medium of publications to circulate among its members and associates the information thus obtained. The phenomenal growth of the Institution demonstrates how thoroughly and persistently the objects for which it was organized have been carried out.

The annual excursions made by the members to various regions accessible from the head-quarters in New York City, are considered by mining engineers, metallurgists, geologists and mining operators as being among the most instructive and pleasant meetings they have opportunities to attend, while it has become recognized that an excursion of this Institute is invariably followed by an increased activity in the regions visited in the mining industry and a general era of prosperity.

Probably nowhere has this been more apparent than in Old Mexico since the Institute held its memorable meeting in that country in 1901. Capital has been invested there in very large amounts to open up old mines, prospect for new ones, construct railways for lines of communication between mining districts and centres of population, and in a word as direct results of this meeting of the Institute, the mining and metallurgical industries in Old Mexico have taken on new life to such an extent that in many centres which furnish capital for mining operations it is useless to-day to attempt to present a proposition from any other section of the country.

In 1903 arrangements had almost been perfected for an excursion of the Institute through British Columbia and to the British Yukon, but unfortunately at the last moment, although two hundred members had expressed their intention to start from New York on a special train, the Canadian Pacific Railway Company found it impossible to take from their ordinary uses the number of Pullman cars requisite for the accommodation of this large party, which was made up of the leading mining engineers, metallurgists and mine operators of the world, consequently the excursion had to be abandoned. There is no reason to doubt that results similar to those which followed the excursion into Old Mexico in 1901, would have manifested themselves in this Province had the excursion in 1903 been found practicable.

During the current month the Institute will be holding its annual excursion and business meeting in the Lake Superior regions of Michigan, and the writer of this article has good reason to feel assured that if at that meeting the subject is properly approached there will be no difficulty in obtaining the promise of the Institute to make British Columbia and the British Yukon the objective points of the annual excursion during the summer or autumn of 1905.

In 1903 the Government of Old Mexico as well as the officials in the different Provinces of that country, fully recognizing the benefits which would be derived from the excursion, put forth every effort to entertain the members and afford each and every one ample opportunity to study the mineral resources and thoroughly investigate the mining industries. The example set by President Diaz and those in authority under him, forms an object lesson for other Governments, and such an example may well be followed by our own or any other Government, because of the manifold benefits which must necessarily result therefrom.

A VISIT TO A GREAT ENGLISH STEEL FOUNDRY.

The *Times* (London) recently published a lengthy account of a visit paid by the Yorkshire section of the Institute of Civil Engineers and others interested in the production or use of steel to Hadfield's steel foundry at Sheffield (represented in this country by Messrs. Peacock Brothers, of Montreal, who kindly forward us the cutting in question.)

The visitors were first conducted to the large machine shop of the works, where a number of projectiles made by the company were exhibited. Many of these had been fired through armour plates; and the efficiency of the "cap" of mild steel, now so largely used, was well illustrated by the specimens. A large 12-in. shell that had gone through a 7-in. nickel-steel plate appeared none the worse for the tremendous ordeal it had gone through, being only very slightly scored or scratched on its sides. A 6-in. shot which had penetrated a 9-in. steel plate also seemed to be in excellent condition. Other capped projectiles which had been fired through plates were also no more than slightly marked whilst broken fragments of like projectiles that had been put to the test without the cap testified to the advantage of that addition.

Later on the visitors proceeded to inspect the foundries, machine shops, and other departments under the guidance of the chairman and directors and members of the staff. In the course of the inspection a number of tests were made, to exhibit the remarkable properties of some of the steel manufactured by this company. Trials were also made at the proof

butts, a couple of rounds being fired against a Hadfield cemented plate. A capped projectile went right through the plate without damage, whilst the uncapped projectile was broken up on the face. The late Mr. Robert Hadfield, the father of the present chairman of the company, held opinions that cast steel could be used not only for common shell, but also for armour-piercing shell. This view was opposed to the convictions of the metallurgists and artillery experts of the day; but the Government officials, with an open-minded liberality of opinion—a characteristic for which Government officials do not always get credit—encouraged Mr. Hadfield to proceed, and ultimately the result of tests made showed that the Hadfield cast-steel projectiles were suitable for perforating wrought-iron and compound plates. This was about 15 or 16 years ago, and since that time great advances have been made in the manufacture of armour. The compound system—i. e. a wrought-iron backing with a steel face—has given place, first to Harveyized plates, and, later, to the armour made by the process of chilling chromium steel on the process first introduced by Krupp, of Essen. The greatly superior resisting power of plates of this description naturally set the projectile makers a harder task, and for a time foreign manufacturers held an advantage, their lead being attributed to extensive research guided by superior knowledge in metallurgical science. This was notably the case in regard to the projectiles made by Holtzer. Fortunately for the credit of English industry, Mr. R. A. Hadfield, who succeeded to the control of the Hecla works on the death of his father, had developed the scientific and research side of the establishment to a high degree, and was therefore able to offer to our Government a projectile which was proved to be equal to the remarkable Holtzer projectiles. In the trials of armour plates resistance to a Hadfield projectile was officially allowed to be equivalent, as a test of merit, to resistance to a Holtzer projectile.

In the meantime, the increased area of ship's side that could be covered with the new armour—which naturally could be made thinner without sacrifice of efficiency—led to naval gunners demanding a projectile capable of piercing a certain thickness of armour and yet having an explosive charge sufficient to burst the projectile after penetration. The problem set to the steel makers, therefore, was to produce a shell strong enough not to break up on impact, and yet to have a cavity sufficiently large to take a bursting charge of from 4 per cent. to 6 per cent. of the total weight. A steel of remarkable and apparently antagonistic qualities was needed. If the metal were too soft it would fail to penetrate the hard cemented face of the armour; if it were too hard it would be brittle and would fly to pieces without piercing the plate. Naturally the chemists or explosive experts had a great deal to do in working out the whole problem, but that is a part of the subject upon which we do not now speak. It is sufficient to say that the Hadfield cast-steel projectiles combined the two features in a remarkable degree, giving a shell that was able to perforate both the Krupp cemented and non-cemented armour, and which, at the same time, carried a charge sufficient to burst the shell after penetration.

The success of the Hadfield Company was the more remarkable, as the suggestion to use cast steel in place of forged steel, was looked on as chimerical by the leading metallurgical and artillery experts of the day; and it must be said that this view was fully justified by what was known until Mr. Hadfield produced results which upset all previous notions on the subject. One of the most annoying defects of steel shells is their liability to spontaneous fracture. Projectiles are to all appearance perfectly sound, and which from the nature and thickness of the metal should have enormous strength, will break up with a loud report for no apparent reason. The cause for this self-destruction—which may take place when the shell has been made a considerable time—is traceable to internal strains set up in the metal by unequal contraction during cooling. Sometimes a shell will last, in apparently perfect condition, until it is fired, but will break up in the gun under the shock of discharge. It was held, and the conclusion was fully warranted by what was formerly known, that cast

shells would be especially liable to this defect. The contrary was, however, found to be the case in this particular instance, and experience has proved that the cast shell supplied by the Hadfield Company are free from the suicidal tendency amongst projectiles. We are assured that though the larger part of the total number of shells supplied to the Navy are made by the Hadfield Company, and though many thousands of proof and other rounds have been fired, yet not a single case of spontaneous fracture has been reported from the smallest calibres up to the big 13.5-in. shell. The Royal Navy has thus been supplied with a shell which is at once cheaper and superior to the class of projectile formerly in use.

Owing to the introduction of Krupp cemented armour of improved description it has been found necessary to introduce a new type of projectile having a somewhat smaller bursting charge than that of the armour-piercing shell to which reference has been made; the charge of the latter shell being from about 2½ per cent. to 3 per cent. of the total weight. To meet this demand the Hadfield Company have produced what is known as the "Heclon" shell. In testing at their own proof-butts the company have succeeded in sending these shells through plates of a thickness equal to the calibre of the projectile, the latter being in a condition to burst after penetrating the plate. Even better results have been obtained at Shoeburyness, a "Heclon" 6-in. capped projectile having perforated 7 inches of Krupp cemented armour, the shell being recovered in the rear of the plate in a condition for bursting. More recently a further trial of the Hadfield projectile took place before Lord Roberts, when a 12-in. armour-piercing shell, weighing 850 lbs., was successfully fired against a Krupp 9-in. non-cemented plate inclined to an angle of 30 degrees. The velocity was 1,911 foot-seconds, and the striking energy 21,500 foot-tons. This projectile was taken by the Government officials at random from a lot of 400, and if it had failed it would have meant the rejection of the whole order to the value of many thousands of pounds. The fact gives an idea of how much depends on the success of a single round, and the large amount the manufacturer stands to lose in the case of failure of any one projectile. The country may rest assured that under such stringent conditions the manufacturers of projectiles will spare no pains to render every unit absolutely trustworthy.

The Hadfield Company have given attention to means of defence as well as to attack. They have quite recently produced a shield for the protection of gun-mountings which has been found to possess somewhat unusual qualities. It is, like the projectiles, of cast steel, the metal being a special description to which the name of "Era" steel has been given. One of these shields, 6 inches in thickness, was recently attacked by a 17-in. armour-piercing shell, fired at a velocity of about 2,100 foot-seconds, and it successfully resisted the projectile. A 6-in. common shell was next fired at the same plate with a velocity of 2,035 foot-seconds, the striking energy being about 2,875 foot-tons. This merely made a slight indentation about an inch deep. A lydite shell of the same calibre, and with the same velocity and striking energy, was next fired at the shield, the result being similar to that of the last-mentioned round. Finally, the plate was attacked by a 6-in. armour piercing shell, fired with a velocity of 2,039 foot-seconds, and having 2,880 foot-tons striking energy. This effected perforation, though it is believed that the projectile burst on the outside of the plate. Mr. Hadfield states that the "Era" cast steel plate can be yet further improved, but as it stands it is superior to the ordinary forged steel, such as is now used for gun shields, as the latter would have been perforated under any of the above tests. A Krupp cemented 4½-in. plate, which, of course, was forged, broke up under similar tests to those above given. The difference in thickness of the shield and plate must, however, not be overlooked.

These results, especially those obtained with projectiles, possess great interest for both civil and military engineers. It has long been held that to produce trustworthy steel articles it is necessary to put mechanical work on the metal, that is to say, that it should be forged either under the hammer, in the hydraulic press, or by rolling. To attempt to produce steel

structures that would stand the enormous stresses that the Hadfield projectiles and gun-shield have undergone simply by casting would formerly have appeared the height of folly to the orthodox metallurgist or engineer, although there have been a few who have held more sanguine views in regard to the possibilities of the material. It would, of course, be extremely interesting if we could give the means by which the Hadfield Company have achieved these results, but this we are unable to do. The money that is sometimes spent—first in laboratory research, and afterwards in experiment on full scale—represent very large sums indeed, many thousands of pounds often being devoted to the working out of a single detail, or perhaps simply to arrive at a negative result. In the conduct of all industries depending on the scientific application of natural laws this feature is rapidly becoming more and more serious as time passes and the processes of manufacture increase in complexity. One can understand, therefore, that the directors of manufacturing establishments, having spent large sums upon gathering knowledge, look on data thus acquired as one of the assets of the business, and feel they are no more entitled to make such knowledge public than they would be to give away any part of the plant or machinery of the company. It must therefore suffice to say that the success of the Hadfield cast steel is the result of chemical research into the action of often minute differences in proportions of alloys of iron and of the subsequent special heat-treatment the material receives. In both these fields of research Mr. Hadfield has spent much time and labour, as the numerous contributions he has made to various scientific and technical societies bear evidence.

Abroad manufacturers have been quick to recognize the need for a fully staffed and equipped research department, and the amounts expended annually for this purpose in some foreign works appear almost incredible. It is only by enterprise of this nature, however, that manufacturers can keep in the van of progress, and, properly directed, this so-called "non-productive" expenditure brings a rich reward. In Great Britain we have been somewhat apt to relegate research work to the laboratories of professors, the manufacturers devoting themselves to what are styled "practical results." This divorce of practice and theory does not lead to industrial success; and we cannot do better in support of this view than quote from a speech of Sir William White's made at a recent meeting of a technical institution:—

"I do not think it is a wholesome thing to suppose that all research work should be conducted in laboratories separate from works. I have the greatest respect for work done by engineers like Professor Arnold and Mr. Stead in private laboratories, but I hope to see the time when the example of Mr. Hadfield will be more widely followed in this country and when inquiries, both scientific and practical, will be carried out on a very large scale in the works of manufacturers all over the country."

The visitors to the Hecla works were shown other things besides artillery experiments and projectiles, steel castings and forgings of nearly all types being produced. Amongst these the most prominent were the castings for tramway and railway work, both for permanent way and rolling stock. The "Era" manganese steel, the discovery of which was due to Mr. Hadfield, and was the outcome of a long series of laboratory research extending over some years, lends itself especially well to such "track" work as points and crossings. Manganese steel stands alone in regard to being both hard and tough, so that it has very great resistance to wear, or attrition, and at the same time is not brittle, as ordinary hard carbon steel is. The advantage thus offered for railway or tramway points and crossings, which are subject to both abrasion and shock to a high degree, will be at once apparent. Unfortunately the hardness of manganese steel prevents its being machined, as no steel tool will cut it, and it can only be used as cast.

The works of the Hadfield Company cover in all 80 acres. The steel foundry is said to be the largest in the country, probably in the world. It is 1,020 feet long, and covers six acres. The engineering shops, which are filled with machine

tools of the largest size, are also of a most extensive description. The works give employment to over 4,000 men.

CANADIAN MINERAL EXHIBIT AT ST. LOUIS.

FROM a description of the Canadian mineral exhibit at the St. Louis Exposition published in the *Mining World* we take the following:

"The Canadian exhibit at the exposition occupies sections 54 and 64 at the north end of the Palace of Mines and Metallurgy. The exhibit is made up of the whole Dominion instead of by provinces separately, as at Buffalo and Chicago, which has permitted a great variety of display as well as a very imposing exhibit in the aggregate. While the exhibit is confined largely to minerals it is by no means a "show case" display. There are ample quantities of the displayed minerals and in some instances large enough pieces to show the inclosing country rock. The whole is very well arranged with plenty of space for examination and each exhibit is plainly labeled. Advantage is taken of the opportunity to advertise Canada by means of some comprehensive legends. Some of these are as follows: 'Canada supplies over 90 per cent. of the world's supply of asbestos,' 'Canada is the largest producer of mica in the world,' 'Canada supplies one-half of the world's nickel.' 'There are 63,000 square miles of coal in the Northwest Territories,' 'The mineral production of Canada for 1903 was 163,226,510, an increase in ten years of over £43,000,000.' 'Yukon, the land of gold, produced in 1903 \$12,250,000,' 'Nova Scotia produced 5,100,000 tons of coal in 1903,' 'British Columbia produced in 1903 1,428,000 tons of coal,' 'Canada produced in 1903 \$5,728,000 worth of copper, an increase of 700 per cent. in ten years.'

The British Columbia gold, lead and copper ores, Rainy River gold ore and gold quartz from Nova Scotia are fully represented in the exhibits, as also a display of copper ores from Texada Island and zinc ores from Ontario. Among the interesting exhibits is the Sudbury section in which are displayed the pyrrhotite and chalcopyrite, which produce the nickel.

"There is an extensive display of coal ores from Nova Scotia and British Columbia, and of Nova Scotia iron ores as well as other Canadian iron ores. The exhibit also includes a display of building stone and slate. A large mass of ferrosilicon from the Electric Reduction Company, Buckingham, Ontario, represents an interesting industry of Canada.

The artistic climax of the exhibit is a panoply covered with various colored minerals, artistically arranged, under which rests a safe in which, exposed to the view of the public, is \$40,000 worth of gold nuggets from the Canadian Yukon.

"The display is made still more instructive by numerous specially prepared maps and pamphlets describing the exhibits.

"The Canadian exhibit is under the general direction of Mr. R. L. Broadbent, of the Canadian Department of Agriculture."

LE ROI COMPANY.

Managing Director's Report.

THE Le Roi Mining Company has issued a report which has been made by Mr. A. J. McMillan, the managing director of the company, upon his recent investigations in British Columbia. He states:—"I left England for Rossland on April 16th last, arriving there early in May. Returning from Rossland on July 1st last, I visited Montreal and New York on financial business connected with the affairs of the company, which is now satisfactorily arranged for the present, and also to pay a flying visit to London to confer with you. As my visit to England is one of a few days only, and as I am returning to Rossland almost immediately to continue the work already in hand there, this is in the nature of an interim report and will necessarily be brief. As you are aware, we were notified by cable at this office during the first week in April that the Northport smelter had been closed down, owing, as we were subsequently advised, to the want of

suitable fluxing ores. About the same time the illness of Mr. Parrish, the general manager, which had been previously advised, became so acute that he was unable any longer to attend to business. At this juncture the Rossland manager of the Bank of Montreal, after conferring with our Rossland office, cabled over suggesting that Mr. Mackenzie, of San Francisco, formerly general manager of this company, whose services were at the moment available, be asked to immediately take temporary charge as acting general manager. To meet this emergency the directors accordingly authorised his appointment by cable.

"Upon my arrival in Rossland Mr. Mackenzie told me that he had been looking into matters during the few weeks that he had been there, and the result of his investigations was set out in his cable to London of May 9th, which has already been published, in which he stated that Mr. Parrish had made serious over-estimates of profits during recent months, and that he had generally overvalued the assets of the company. As regards the value of the ore reserves in the mine, there is but little difference between the estimates of Mr. Mackenzie and those of Mr. Parrish as set out in his annual report, which was laid before the shareholders in February of this year. Upon my arrival in Rossland, in the beginning of May, I commenced a searching investigation into the condition of affairs prevailing there, which very soon convinced me that there had been great carelessness on the part of Mr. Parrish and his subordinates in connection with the monthly estimates of profits, especially during the months of January, February and March last. Mr. Parrish, who had been ill during a portion of this time, admitted that he could not explain these inaccuracies and resigned his position as general manager. Many other changes have also been made amongst the officials with a view to preventing a recurrence of similar troubles.

"A great deal of low-grade ore has been shipped from the mine to the smelter during the period referred to, ore running very high in silica, and which it was difficult to smelt owing to the fact that proper fluxing ores were unobtainable in sufficient quantity. At the time of my arrival in Rossland, over 40,000 tons of such ore were lying in the smelter yards, and as it was necessary to convert this into money as quickly and as economically as possible, it was decided to take from the mine specially-selected ores of higher grade, carrying the necessary constituents for smelting purposes. By doing this we have been enabled to turn into cash the greater part of the 40,000 tons referred to, thus improving the financial position of the company. Mr. Mackenzie states that the mine is in good condition, and that a very large amount of ore is available. Much of this is high-grade smelting ore, but much of it is of such a grade and character that it can, it is believed, be treated much more cheaply and economically by concentration. In June last we rented a small mill near the mine in which concentration tests are being carried out at the present time under the supervision of Messrs. Bradley and Mackenzie, of San Francisco, who are temporarily acting as consulting engineers to the company. Within a few weeks the result of these tests should be known, and, if they prove satisfactory, it will then be desirable to take steps to treat a large part of our ore by concentration, and by so doing to bring within the scope of profitable treatment a very large tonnage of low-grade ore which will not yield a profit by smelting direct.

"Proposals looking to amalgamation of interests have been made to us by companies owning other mines in British Columbia with a very large tonnage of ore developed, and under your directions steps are being taken to look into this matter. Provided a proper basis of agreement can be arrived at, there is much to be said in favour of one company owning various properties in order to ensure a constant supply of various kinds of fluxing ore for the smelter and a large tonnage for the concentrating works which will apparently be necessary to deal with low-grade ores. Such a policy properly carried out should result in many economies.

"Since my arrival in Rossland, three months ago, the staff has been largely reorganised and the work re-arranged in such a way as to greatly reduce expenses there. Other changes and improvements in these respects remain still to

be made on my return. Our contract with the refiners having run out, a new contract, arranged by Mr. Wilson, the smelter manager, has been entered into for the disposal of our smelter product to greater advantage than hitherto, an arrangement by which we realise upon the output much more quickly than formerly, and also save largely in the matter of bank interest and charges. The Le Roi mine is one of great value. As I stated at the last annual meeting of this company, in order to make the most of its value it is important to obtain a large tonnage of suitable fluxing ore for smelting purposes, and it is also essential to be able to utilise profitably the enormous tonnage of low-grade ore in the Le Roi mine itself. Hence, I am looking carefully into the question of amalgamation of interests and concentration, believing that, if these can be satisfactorily carried out they will result in placing the Le Roi on a sounder basis. I am returning to British Columbia at once to deal with the various matters referred to in this report."

SLOCAN CITY MINING DIVISION.

Some Midsummer Notes By W. D. McGregor.

THE season has been marked by steady improvement in the mines and by distinct depression in commercial circles. This latter is to be accounted for by the fact that too many traders were attracted to the district by the high prices prevailing. The limitation in volume of business necessitated high prices, which turned many customers into other markets, thus still further reducing the local demand. However, the signs are that the stringency will soon right itself. As far as the camp proper (the working and developing properties) is concerned things could not well look better.

In the triangle between 10-Mile and Springer Creeks the Hampton, Enterprise, Ottawa, Club, Colorado, Neepawa and Happy Medium are all taking out ore that sorts to \$100 or higher per ton.

On the north side of 10-Mile the shipment of high-grade ore from the Highland Light and the uncovering of what is almost certainly an extension of the Enterprise lead by Griffith and his partners, seem to be the main items of interest.

On Lemon Creek the state of the Black Prince and the commencement of work with a large crew by the new owners, the shipments from the Alberta group, and the mill test of 20 tons of Kilo ore which gave \$20.50 per ton on the plates, are the principal features.

Among the general news items for August the visit of Mr. Thos. A. Noble, of Pittsburg, Pa., principal owner of the Ottawa group, probably ranks first. Mr. Noble expressed freely his satisfaction with the camp, and his mine and its management in particular. This he might well do as he stated that the property had already paid for itself and that the net profit in July was about \$20,000. He and his associates have since purchased the adjoining group of nine claims and will proceed to develop them.

Mr. W. F. Robertson, Provincial Mineralogist, spent some time in this district and his remarks may be condensed into three short sentences. The camp has been victimized by humbug mining: there are a number of properties idle that should be at work, and the camp on the whole is distinctly more promising than he expected to find it.

This year's ore shipments from the division have already reached 1,450 tons, an increase over the full year's shipments for 1903. There is also a marked increase in the value per ton.

RECENT MINING DECISIONS.

WE are indebted to the Hon. Mr. Justice Martin for the following copy of a judgment recently delivered by him at Nelson in an important case involving the question of extra-lateral rights.

LAST CHANCE MINING CO. LTD. VS. AMERICAN BOY MINING CO. LTD.

It is admitted that the defendant company, owning the "American Boy" mineral claim, crown granted, has trespassed upon and abstracted ore from the plaintiffs' adjoining mineral

claim, i.e. "Last Chance" also crown granted; and the questions to be decided are two. (1) The measure of damages. (2) The amount thereof.

As to the first, the plaintiff company contends that the wrongful taking was wilful, deliberate, and without colour of right; while the defendant urges that it was innocent and accidental, and therefore brought within the principle of such a case as *Wood v. Morewood* (1841) 3 Q. B. 440. Though there is something to be said in support of the graver contention, yet as it is tantamount to a charge of theft (for there is no moral difference between fraudulently taking an ingot of gold out of a mine owner's office above ground, and fraudulently and secretly abstracting valuable gold bearing ore from his claim below ground) a very clear case would have to be made out to support it and the evidence does not warrant that conclusion here. There is however no difficulty in holding that the defendant must be found guilty of negligent abstraction, for with a full appreciation of the close proximity of the plaintiff's boundary line and the risk incurred the work was continued at the place in question in general defiance of those ordinary precautions which ought to be observed under such circumstances: and in particular the contemplated survey should have been made before any more work was done in that locality. It is manifestly of the first importance that owners of adjoining mining claims should define their boundaries, and especially where extra-lateral rights are known to exist. This rule is so well settled that it is almost unnecessary to cite authority for it, but if any be needed it will be conveniently found in *Lindley on Mines* (2nd. Ed. 1903) vol. 2 No. 868 pp. 1603-4 where the cases are summarized as follows:—

"It is the duty of the owner of a mine on approaching his boundaries to make surveys to prevent encroachment on the adjoining lands, and the least evidence of bad faith on his part would make every intendment in favour of the injured party."

The defendant herein being found guilty of negligence the measure of damages is the same as if he were a wilful trespasser. What that measure is has been often considered, but the two cases of *Trotter v. MacLean* (1879) 13 C. D. 575, and *Livingstone v. Ravyards Coal Co.* (1880) 5 A. C. 25 set it forth very clearly. It is there laid down that there are two rules for determining the said measure, a milder and a severer. The former is, that where the taking has been *e. g.* inadvertent, or under a bona fide belief in title, or by mere mistake, or where the owner has notice but stands by, there will be allowed to the defendant the costs of severance of the coal from the realty, as well as of bringing it to bank. The latter is, that where there has been *e. g.* fraud, or negligence, or wilfulness, only the cost of bringing to bank will be allowed. And in each case the value of the mineral taken is its value at the time it was taken to the person from whom it was taken. Lord Chancellor Cairns in *Livingstone v. Ravyards* pp. 31-2 and Lord Blackburn at pp. 39-40.

These rules are practically the same in the United States, and are conveniently stated in *United Coal Co. v. Canon City Coal Co.* (1897) 18 Morr. M. R. 639 thus:—

"We are also of the opinion that the district court applied a correct measure of damages. The defendants being wilful trespassers, it was proper to allow the full value of the coal mined, without deduction for their labour and expenses in mining the same, the rule of damages being the value of the ore at the time and place it is severed from the realty. If the court had found that the trespass of the defendants was innocent in character the rule would have been the value at the time of the conversion less the amount which the defendants by their labour had added to that value—*Omaha R. Co. v. Tabor* (1889) 13 Colo. 41, 21 Pac. 925; *Woodenware Co. v. U. S.* (1882) 106 U. S. 432, 1 Sup. Ct. 398."

And see also *St. Clair v. Cash Gold Mining Co.* (1896) 18 Morr. M. R. 523 and *Lindley, supra*, wherein it is laid down:

"If the trespass is the result of an honest mistake, the defendant is compelled to pay only the value of the ore as it was at the mine, and can therefore limit the recovery

"first by the value of what is taken; second by the cost of mining, extraction, hoisting to the surface, or delivering it at the pit's mouth.

"If, on the other hand, the defendant takes out the ore, not as the result of an honest mistake, or an honest intention but under circumstances that show that he has knowledge of the situation, he is entitled to no deduction, and he may not reduce the recovery by proving the cost of mining."

Coming then to the second question, the amount of damages. Now at the outset it is to be remarked that a trespasser finds himself placed in an unenviable position, and has to assume several heavy burdens.

First—"He cannot charge the person whose property he has invaded with the expenses of the exploration incidental and necessary to finding it (i.e., ore), or reaching the vein which he spoils by his trespass."—*St. Clair v. Cash Co. supra.* p. 529.

Second—He must "show what he did and the value of what he took."—*Ib.* 530.

Third—He must "respond in damages to the highest limit of recovery unless able to satisfy the jury of the honesty of (his) purpose and the good faith with which (he) did the work."—*Ib.* 532.

Fourth—He must, where he has mixed the ore taken by trespass with his own so that the plaintiff is unable to distinguish it, be prepared to do so clearly to the satisfaction of the jury, otherwise the plaintiff may recover the value of all the ore shown to have been taken out, and the plaintiff's recovery is limited only by his own evidence on the subject; nor can the defendant complain if the jury fix a large estimate upon the damages.—*Ib.* 532 Lindley 1605.

"And although the evidence of the defendant may have been entirely uncontradicted, it by no means follows that the jury would have allowed the totality of the expenses as exhibited by the proof offered."—*Ib.* 528.

These consequences are really but the natural result of the application to mining operations of well known principles long ago enunciated in *Armory v. Delamirie* (1722) 1 Strange 504 wherein it is laid down:

"When the nature of a wrongful act is such that it not only inflicts an injury, but takes away the means of providing the nature and extent of a loss, the law will aid a recovery against the wrongdoer and supply the deficiency of proof caused by his misconduct by making every reasonable intendment against him in favour of the party injured. A man who wilfully places the property of others in a situation where it cannot be recovered, or its true amount or value ascertained, by mixing it with his own, or in any other manner, will consequently be compelled to bear all the inconveniences of the uncertainty or confusion which he has produced, even to the extent of surrendering the whole, if the parts cannot be discriminated, or responding in damages for the highest value at which the property can reasonably be estimated."

Applying the foregoing to the case at bar, I find that the defendant has to a greater or less extent mixed its own and the plaintiff's ores, or at least has failed to satisfactorily identify and distinguish between the various shipments, which amounts to the same thing. There is no definite information of the original shape or extent of the confiscated ore body, so the plaintiff has been forced to resort to scientific evidence, and as best it may on the existing meagre evidence of former extent, to reconstruct it, with the assistance of an experienced mining engineer: but in answer to which the defendant submits a counter reconstruction showing a much smaller ore body based on its view of the facts so far as they have been proved.

In such circumstances, and because of the defendant's wrong-doing and failure to furnish precise proof of what was done the whole question of extent becomes almost entirely a matter of inference and estimate, and I see no reason, on the facts which I feel justified in giving effect to, why the contention of the plaintiff as to the amount and value should not be accepted, as calculated by the witness Fowler; i.e., eighty-four and one-tenth tons. It would appear to be a

safe rule to adopt in such circumstances that where there is no reason to materially discredit a reconstruction made, as here, by a disinterested mining engineer of high standing having special knowledge of the mineral formations of the locality in question, such a reconstruction may be assumed to be substantially correct.

As to determining the exact value of the ore taken that may here be safely arrived at from the smelter returns of the three cars (Nos. 466-8) admittedly taken from the plaintiff's winze, because if the missing ore body were not part of that which was tapped by the winze it was in all probability the nearest lenticular mass of similar nature and may properly be taken for the basis of an estimate in accordance with the rule above cited.

Applying therefore the severer rule to this case, the cost of mining, estimated at \$3.25 per ton, will be disallowed, but the following deductions should be made from the smelter returns:—

Sacking ore	per ton	\$.30
Raising ore from working face	"	.25
From surface to railway, including tramming	"	1.50
Freight and smelter treatment	"	15.00
Total per ton		\$17.05

In regard to the claim to increase the value by adding the amount of the Dominion Government lead bonus it is sufficient to say that it was not granted till long after the trespass complained of, and the value, it has been seen, must be taken to be as it was at the time of the trespass.

The matter of calculating the exact value of the ore on the above basis, by taking the prices of silver and lead at the time of the trespass, is referred to the Registrar in case the parties cannot agree on it; and judgment will be entered according to the result of the calculation. In case any difficulty arises before the Registrar the matter may be referred back to the Court.

So far as regards judgment being entered against the defendant McGuigan that may be spoken to, for it was apparently overlooked by counsel on the argument.

Delivered at Nelson, B. C., June 30, 1904.

Signed, A. M., J.

CENTRE STAR VS. ROSSLAND MINERS UNION.

Judgment in the case of the Centre Star vs. the Rossland Miners Union, et al., has been handed down by Mr. Justice Duff. The case was heard in Victoria recently before a special jury, and occupied several days, resulting in a verdict for the plaintiffs, damages being set down at \$12,500. A great deal of interest centered in the case as it practically involved the responsibility of the union for the actions of its officers. The judgment is as follows:

"I think there was evidence on which the jury could properly find for the plaintiff on all the questions submitted to them. The defendants' application for a nonsuit is therefore dismissed.

"The plaintiff company is, on the findings, entitled to judgment against the Western Federation of Miners, Rossland Branch, both under that name and under the name by which the organization was known, viz., The Rossland Miners' Union, No. 38, Western Federation of Miners, for \$12,500, the amount of damages found by the jury; and judgment for this amount should also be entered against all the principal defendants except those joined for conformity only. There will be an injunction against all the defendants as claimed by the plaintiff company at the trial."

LYMAN P. DUFF.

A temporary injunction was afterwards granted restraining the defendants from transferring any of their property, and Mr. C. V. Jenkins was appointed receiver to take charge of all revenue accruing to defendants. An appeal is to be taken on behalf of the Union against the judgment, as above stated.

NOTES FROM MINING CAMPS.

ROSSLAND.

Work has been resumed on the Homestake and Gold King properties. A shipment of ore is being made from a surface showing on the Homestake to the Trail smelter. The Gold King is south of and adjoining the Jumbo.

The concentration tests of ore from the Le Roi mine that have been in progress for several weeks have been completed and now the return to Rossland of the Managing Director is being awaited for an announcement as to the company's future policy in this direction. It is regarded as very probable that the company will shortly proceed with the erection of a concentrator at the mine, the works to have an initial capacity of about 100 tons per day.

NELSON.

Special efforts have been made to secure a large and representative display of minerals at the Nelson exhibition, to be held during September. Several collections have been promised as competitors for the Challenge Cup to be awarded to the best exhibit, besides which individual mine-owners have arranged for space for the display of ores of different grades from their respective mining properties.

YMIK.

The Hunter V. mine, Porcupine Creek, is shipping about 100 tons of ore a day to the Hall Mining & Smelting Company's smelter at Nelson.

Mr. E. W. Widdowson is again making a collection of Ymik district ores for exhibition purposes. A challenge cup is to be awarded at the Nelson exhibition, to be held this month, for the best mineral exhibit, and Ymik intends to win it if it can.

In the Wilcox mine a five-foot vein has been encountered in one of the tunnels, assaying up to \$24 in gold four feet of its width and much higher values for the remaining twelve to fourteen inches. There is enough ore of good grade in sight to keep the mill supplied for a long while.

MOYIE.

The St. Eugene mine is working about 300 men and is shipping its ore, which contains a large percentage of lead, to the Nelson and Trail smelters to the extent those works can take, and the surplus is being sent to Antwerp, Belgium. A new hoist has been installed at the St. Eugene.

The passing of the Dominion order-in-council authorising the payment of a bounty of \$10 per ton on lead mined in Canada and shipped to Europe (but not to the United States) will benefit the St. Eugene mine, probably more than any other lead mine in the Province.

SLOCAN.

Mr. Jas. Cromm, manager of the St. Eugene mine, at Moyie, East Kootenay, is reported in the district Press to have stated that he had been assured by the Government that money would be expended to develop zinc mining in the Slocan, but he was not at liberty to say what form the expenditure would take.

The purchase of the Mayetta group of nine claims, situated in the neighborhood of the Ottawa, in the Slocan City mining division, has been completed. The buyers are stated to be the owners of the Ottawa.

Messrs. D. T. Hodnett and H. P. Shiftell, of Bossburg, Washington, have secured a two-years' lease and a bond for \$10,000 on the Mountain Goat mineral claim, situate in the Jackson Basin and owned by Mr. A. T. Garland, of Krslo. Very little development work has yet been done on the claim, but there are some fine ore-showings exposed at the surface.

A new zinc separator, larger than the one heretofore in use at this mine, has been installed at the Payne, near Sandon, increasing the output of the zinc by-product from the silver-lead concentrator.

The Kootenay Ore Company is endeavouring to complete arrangements that will warrant the addition to its works at Kaslo of plant to raise the zinc contents of zinc concentrates to 50 per cent. zinc before shipment to Kansas or Belgium.

POPLAR CREEK.

The lead lavelly cut in the lower tunnel of the Spyglass is reported to be gradually widening as development proceeds. The paystreak is about a foot in width and is rich in free gold and native silver. One specimen, about 12 in. by 18 in. shows native silver on all sides and free gold appears in places. This lead has been proved to a depth of 100 feet.

The Swede group continues to show much rich specimen ore, with gold frequently appearing in it.

High-grade galena ore has been met with on several properties, among others on the Mother Lode and on the Morning claim, the latter being on Rapid Creek.

A few men are making pay at placering on Lardeau River, taking out gold from fine dust to nuggets valued at \$2 to \$3 each. The results obtained by several are encouraging a renewal of placer operations on this stream, which is alongside the railway.

LARDEAU.

The company owning the Mohican group, on Gainer Creek, North-east Lardeau, intends driving some 600 to 700 feet during the coming winter to tap the main ore shoot at a depth of 250 to 350 feet. The surface showing is a contact vein varying in width from 5 to 20 feet. The ore contains galena, copper, zinc and iron pyrites.

On the Bonanza group, in the Lucky Jim basin, east of Trout Lake, a tunnel is in 125 feet on a vein of carbonates and galena with grey copper. The paystreak varies from 3 to 12 inches in width.

CAMBORNE.

The latest news from the mines about Camborne, which were in great danger of having all their surface works destroyed by fire, forest fires having done much damage in the neighborhood lately, is that after a hard fight with the fire for six days and nights rain came and extinguished it. The aerial tramway and mine buildings of the Oyster-Criterion properties of the Great Northern Mines Ltd., were saved; the upper terminal and some of the towers of the tramway and the mine buildings of the Eva mine were burned, and the Goldfinch suffered similar loss. The Eva expects to be in a position to resume work within a fortnight.

BOUNDARY.

A 14-inch vein of ore was encountered last month in the shaft of Barbara, a claim adjoining the town of Greenwood on the east. The ore is galena, zinc-blende and copper in a quartz gangue. The claim was under bond to several miners last year, but after doing a lot of work without success they gave it up.

The main shaft of the Brooklyn, at Phoenix, one of the mines lately acquired by the Montreal & Boston Consolidated Company, is being enlarged and ore-bins for this mine and the adjoining Stenwinder are being erected alongside the railway.

Grading is in progress for three tracks to give shipping facilities for ore from the Granby Company's No 4 tunnel over the Great Northern branch line now in course of construction.

Preparations are being made to install a second large Farrel-Bacon ore-crusher at the B. C. Copper Company's Mother Lode mine, near Greenwood.

Ore shipments from Boundary mines for the current year now aggregate about 525,000 tons. The total for the whole of last year was 685,272 tons, so this year's increase should be considerable.

SIMILKAMEEN.

A recent advice from Hedley states that a 10-ft. vein of ore assaying up to \$208 per ton in gold has been discovered on a claim on Sterling Creek, which flows into the Similkameen River south of Camp Hedley.

YALE.

The Mount Baker & Yale Mining Company's 10-stamp mill at Siwash Creek, near Yale, is about completed, and will probably be in operation before the close of this month. The company has a group of eight mineral claims through which

runs a vein that has been crosscut in four places. This vein is being opened up and the first work the mill will do will be on ore now being taken out in the course of development.

CARIBOO.

Earlier reports of the favourable outlook for the deep placer and the big hydraulic mines of Cariboo are being confirmed by results. The output of gold from the district for July, says the Kamloops *Inland Sentinel*, shows an increase of more than \$38,000 as compared with the corresponding month of last year. For July, 1903 the output was \$63,198.60 while the total for July of this year was \$101,280.15. Nearly half this increase was contributed by the Consolidated Cariboo Hydraulic mine, which sent out about \$63,000, the result of its first clean-up this season as against \$45,453.60 its total output for all last season. Apart from this big mine the general output for this district has already more than doubled last year's production from all other sources in the district. Cariboo will probably have a larger total production this season than for several years past.

ATLIN.

A. E. Larson, who is working a lay on the American Mining Company's property, on McKee Creek, is reported to have picked up a nugget of gold weighing 44 ozs. 11 dwts.

THE COAST.

The Cascade Copper Mining Company last month shipped about 150 tons of copper ore from its Cascade mine, situated on Uchucklesit Harbour, west coast of Vancouver Island, to the Tacoma smelter. It is stated that the smelter returns were \$22.40 per ton after the deduction of smelting charges. To facilitate the shipment of ore a gravity tramway has been constructed at the mine, running from the mine workings about 600 feet down to salt water. It is proposed to sink a shaft 100 feet before shipping any more ore.

Ore from the Marble Bay mine, Texada Island, has lately been shipped to the Tyee Copper Company's smelter. Heretofore the whole of the product of this mine, the most important on Texada, has been sent to Tacoma.

TRADE NOTES, CIRCULARS AND CATALOGUES.

THE Canadian Westinghouse Company, Limited, of Hamilton, Ontario, recently closed a contract to furnish the Shawnigan Water & Power Company, Shawnigan Falls, Quebec, with a 6600-k.w., two-phase, 2200-volt, 3600 alternations, 180-r.p.e. rotating field alternator, for direct connections with water wheel. Two 2200-k.w. oil-insulated water cooled transformers, 2200-volt primary, 50,000-volt secondary, are included in the contract.

Messrs. Hadfield's Steel Foundry Co., Ltd., Sheffield, England, have received an order for ten of their large gyratory crushers, size "T," having a combined capacity of 750-1000 tons per hour, which are all intended for one plant of the Premier (Transvaal) Diamond Mining Company.

The Jeffrey Mfg. Co., of Columbus, Ohio, U.S.A., have profusely illustrated in their new Catalogue No. 67a their "Century" Rubber Belt Conveyors, which are designed to carry coal as well as ores, broken stone, sand, gravel, etc., and can be furnished to convey material to almost any distance. The sectional conveyors illustrated are manufactured under the Anderson patents, while many of the other devices shown are protected by patents. This company also send us a copy of their instructions for the care and operation of Direct Current Electric Generators of their manufacture. This bulletin (No. 9) should be secured by all those who are in any way responsible for the successful operation of generators.

The Kimplen Crusher & Pulverizer Co. of Chicago, U.S.A., after 50 years of experience in manufacturing crushers and pulverizers of nearly all kinds, have endeavoured to design a machine that will meet all requirements, both in strength and capacity, as well as durability. A sample of Wisconsin granite sent us, reduced by one of the Kimplen Ore Crushers, once through, demonstrates what a thoroughly high-grade, up-to-date machine Mr. Kimplen has designed and manufactured. All interested in their machines, may have a

reasonable amount of material "worked up," provided the expense of transporting the material to and from the machine is covered by those desiring demonstration.

The "Little Wonder" Air Hammer Rock Drill, attention to which has been brought in an advertisement in this issue, has met with great success by the Meramec Quarry Co., St. Louis, Mo., who found it to be the most satisfactory drill they ever operated in hard limestones. Its simplicity commends it strongly and all that is necessary to keep it going is the sharpening of drills. Any boy can work it, and it is not hard or tiresome on the operator. It is known to have drilled eight inches through limestone in four minutes time, but in quartz or granite it could not drill as rapidly.

The Wetherill Separating Co., New York, N.Y., have on exhibition at the Universal Exposition, St. Louis, 1904, in the Mines and Metallurgy Building, New York State space (Block 21): Type "E" No. 3, separating magnetite from horn-blende and apatite; North Carolina Geological Survey space: Type "E" No. 1a, separating monazite from garnets and gangue.

COMPANY NOTES / ND CABLES.

LE ROI, (ROSSLAND.)

The following are the July returns cabled to the London office of the Company from Rossland: "Shipped from the mine to the Northport smelter during the past month 6,522 tons of specially-selected ore, containing 3,263 oz. of gold, 3,067 oz. of silver, 173,700 lb. of copper. Estimated profit on this ore, after deducting cost of mining, smelting, realisation, and depreciation, \$21,500. Expenditure on development work during the month, \$5,000; concentration, \$2,250."

ARLINGTON (ERIE.)

The Hastings (British Columbia) Exploration Syndicate, Ltd., sends advice as follows: "During the month of July smelter returns from five carloads of ore were received, amounting to \$4110.84. The total expenses for the month, including development, were \$3343.45. During the month 143 feet of development work were done."

TYEE COPPER CO. (LADYSMITH, V. I.)

"During July the smelter ran 17 days, smelting 3,625 tons of Tyee ore, giving a return after deduction of freight and refining charges of \$48,878. Shortness of run was due to necessity for repairs to aerial tramway from mine to railway."

HALL M. & S. CO. (NELSON.)

A statement of lead ore receipts at the Hall Mining & Smelting Company's smelter, Nelson, during twelve months ended June 30, last, has been published. It shows that 16,677 tons were received and that the lead contents totalled 14,042,688 lbs. The Highland mine, Ainsworth shipped 3,574 tons from which 4,941,075 lbs. of lead were obtained. Other large shippers were: Rambler-Cariboo, (Slocan), 1,913 tons, containing 1,501,202 lbs. of lead; North Star (East Kootenay), 1,154 tons, 931,704 lbs. lead; St. Eugene (East Kootenay), 1,036 tons, with 1,392,220 lbs. lead; Ruth (Slocan), 928 tons, with 998,759 lbs. lead, and Reco (Slocan), 576 tons, with 508,436 lbs. lead. These ores all contained silver besides.

FLATHEAD VALLEY OIL LANDS DEVELOPMENT COMPANY.

THE prospectus of this company, which has been formed in Victoria for the purpose of acquiring prospecting licences, prospecting for oil, and buying and selling oil lands in the Flathead River Valley, South-east Kootenay, has been advertised, and it is stated that sufficient stock has already been sold to allow of the company proceeding to carry out the objects for which it has been organized. At a meeting of the directors held in Victoria on August 17 options of six sections each of an area of 640 acres were exercised and the lands transferred to the company. These were acquired on more favourable terms than are now obtainable owing to competition among prospective purchasers, of whom quite a number are from cities south of the Inter-

national boundary line. This company proposes to deal extensively in the oil lands of the Flathead country, and Mr. W. F. Teetzle, of Nelson, who is one of the directors, is securing such other options as seem suitable for the purposes of the company.

COAL MINING AND PROSPECTING.

MR. R. D. Fetherstonhaugh, who left Atlin on July 4 to examine and report on the coal lands of the Atlin-Tooya Coal Prospecting Syndicate, situate on the Tooya River, near Telegraph Creek, has returned to Atlin. The Atlin *Clam* reports him as having stated that this coal showing has not been in any way over-estimated for there is on the property the largest surface outcrop of coal ever known in Canada or, in fact, America.

Representatives of the Kootenay Coal Company, a Spokane flotation, recently visited Victoria, where they stated that their company is making arrangements to begin mining operations on its lands on the Flathead River, South-east Kootenay.

At the Western Fuel Company's collieries development work is being actively proceeded with, at Northfield No. 4, where a new level is being driven. This is forward enough for more men to be put on making entries to open up this part of the mine. At No. 1 work at the new pithead, in place of that lately destroyed by fire, is making good progress.

The Crow's Nest Pass Coal Company, so it has been announced, has entered into an arrangement with the American Coal & Coke Company, of Butte, Montana, for the sale of all coal and coke sent to Montana points from the collieries of the former company. It is anticipated that the smelters at Anaconda, Butte, Helena, and Great Falls will be good customers for Crow's Nest coke.

THE NICKEL PLATE MINE, SIMILKAMEEN.

IN Mr. Geo. E. Winkler's interesting description of the Nickel Plate mine, on Twenty-mile Creek, Similkameen, published last month in the *MINING RECORD*, it was inadvertently printed that the Nickel Plate vein is about 8 feet wide. The main lead on this valuable property is eighty feet in width. This correction is the more necessary since reference was made in the article to "this large mineralized zone" and to the "glory hole" in which ore was being broken down, which descriptive terms are appropriate when applied to an 80-ft. ore body, though perhaps not warranted in connection with an 8-ft. vein.

PATENTS ISSUED TO BRITISH COLUMBIA INVENTORS.

Mr. Rowland Brittan, Patent Attorney, of Vancouver, sends the following list of patents recently issued to British Columbia inventors:—

Alfred Taylor, of Victoria, has received a Canadian patent on an improvement in bedstead construction, which has been previously referred to.

H. Gilley, of New Westminster, a Canadian patent on an improved self-oiling sheave block.

John McLean, of Vancouver, and L. G. McKam, of New Westminster, a Canadian patent on an improvement in saw teeth.

TRAGIC DEATH OF OTTO M. ROSENDALE.

A press despatch, published after the first forms of the *MINING RECORD* had been printed, gave information of the death by suffocation of Otto M. Rosendale, of Portland, Ore. The news came too late to admit of the withdrawal of the editorial note referring to the deceased which appears in this issue.

MINING MEN AND MATTERS.

Prof. A. Van der Naillen, of San Francisco, Cal., who for over thirty years conducted a School of Practical Engineering, has just received the honors of being appointed by the Belgian World's Fair Directors, a commissioner, to represent California at Liege, Belgium, from April to November, 1905.

The appointment of Mr. Daniel Davies, of Ferme, as attorney for the Crow's Nest Pass Coal Company, Ltd., in place of Mr. Wm. Blakemore, has been gazetted.

Several matters in which mining companies are interested came before Mr. Justice Martin, sitting in chambers in Victoria on 17th ulto. In the matter of the Noble Five Consolidated Mining Co. vs. Last Chance, an application to postpone trial until the February sittings of Court was granted, by consent. In Last Chance vs. American Boy, fiat for \$450 increased counsel fee was granted. Mr. Chas. V. Jenkins, of Rossland, was appointed liquidator of the Giant Mining Company, subject to affidavit of publication of notice; question of security was adjourned.

Mr. Paul S. Couldrey, formerly manager for the Le Roi No. 2, Ltd., is expected to visit Rossland early this month.

It is reported that a stampede from Hazelton, at the head of navigation on the Skeena River, has been occasioned by a reported rich strike of free milling gold rock at Hunter's Basin in the Bulkley Valley.

Messrs. J. C. Gwillim and Wilson have been looking over C.P.R. coal lands in the vicinity of the Upper Elk and Fording Rivers.

Mr. A. J. Swimney, of Ferguson, manager for the Silver Cup Mines, Ltd., and the Great Western Mines, Ltd., has returned from a trip east whence he is reported to have been for the purpose of purchasing additional plant for the Silver Cup.

Rossland friends of Mr. S. F. Parrish, late general manager of the Le Roi Company, have presented him with an engrossed address and a diamond ring.

Mr. W. J. Sutton, geologist to the E. & N. Railway Company, of Vancouver Island, attended the American Mining Congress at Portland, Oregon, last month in the capacity of representative of the City of Victoria and of the Provincial Mining Association of British Columbia.

Mr. E. J. Wilson has retired from the management of the Le Roi Company's smelter at Northport, Washington. It is stated that Mr. J. H. Mackenzie will now direct operations at these works.

Mr. Thos. Jones, representative of the Lanyon Zinc Company, of Iola, Kansas, U.S.A., recently visited the Peerless and other mineral claims in the vicinity of Quatsino Sound, on the north-west coast of Vancouver Island, to examine showings of zinc ore reported to occur there. He returned to Sandon late in the month, but is expected to again visit Quatsino shortly.

Professor T. L. Walker, of the University of Toronto, has been spending a few days in Ymir camp, where he visited several of the more prominent of the mines. Ymir will hereafter be well represented in the university's collection of minerals.

Mr. H. A. Guess, for the past three years chemist to the Silver Lake mines, Silverton, Colorado, has resigned to accept the position of chief chemist of the Cananea Consolidated Copper Company, Cananea, Mexico. Mr. Guess, in partnership with his brother, formerly had an assay office at Greenwood, and five or six years ago went thence to the Rainy River district, Ontario.

In reviewing recent transactions on the London stock market the *Mining Journal* observed: "Le Roi were carried over at 2d. back to even, but whether they have been realised or sold speculatively does not appear. There is a party working for reconstruction, but it is to be hoped that the board will see their way to resist. If the reconstruction party gets its way they should be questioned as to dealings in the shares."

Fernie, the largest town and the business centre of the Crow's Nest Pass coal region, has been incorporated, and a mayor and aldermen have been elected.