the mine can stand the cost of it, and after the mines have attained a certain depth it will often be found to be the only one possible. Luckily for mine managers conditions such as above described are not likely to exist very often, and if they do exist in the upper levels, it is to be expected that the ground will get harder and less liable to cave as depth is attained.

Mr. BERNARD MACDONALD, Rossland—I have read Mr. Woakes' criticism on my paper, "Mine Timbering by the Square Set System" and also that gentlemen's excellent article in Vol. XXIX of the Transactions of the American Institute of Mining Engineers, describing the Darien Mine, with great interest. I am sure any one who gives himself the pleasure of reading Mr. Woakes' description of this mining property will find corroborative evidence of the proposition that "no two mines are exactly alike."

In replying to Mr. Woakes' criticism I do so with the full knowledge of the difficulty of prescribing for a patient, without first seeing him and studying the idiosyncrasies of the malady. Therefore, the method of stoping and timbering the ore bodies in the Darien Mine, which I would propose as best suited for the peculiar conditions existing there would be considered as given under existing circumstances.

As a general rule when an underground ore body is being mined, greater strains are exerted on the timbers by the pressure on the enclosing walls than from the overhanging ore. On this account, the method of extracting the ore body generally adopted is by stopes or steps running horizontally within the vein and along it over the various levels and the spaces thus exhausted are timbered by "floors" or square sets extending horizontally between the enclosing walls. This is the method described in my paper.

But it seems that the generally prevailing conditions in mining operations were quite reversed at the Darien Mine, where the greater strains came from the overhanging ore, instead of, as is usual, from the enclosing walls. This might, in a measure, have been suspected from Mr. Woakes' description of the physical characteristics of the ore and the nearly vertical dips of the enclosing walls.

I would meet these reversed conditions by reversing the usual methods, or I should say direction of the stoping and timbering, viz.: I would run the stopes or steps of the excavation vertically upward between the mine levels, instead of horizontally over them.

For example: in stoping out any block of ore developed between two levels, I would first run a raise vertically through it, making such raise wide enough to be timbered into two compartments by two square sets going up in it side by side. When completed, this raise would furnish means of ventilation and access for men and material to whatever part of the ore body the work of stoping might be going on. I would then run all the stopes vertically upwards around this raise, commencing at the lower level and finishing at the upper level, mining out just enough ore at a time to admit of one new set of timbers being placed in the evcavation. By this method all the ore, except the one stope being excavated, would be supported on a solid foundation of ore in place. In case lateral or vertical pressure would give the timber sets a tendency to swing or "jack knife" out of their true horizontal and vertical position, as would probably be the case, I would keep the skeleton frame work of the sets filled up with broken ore, until all the block between levels was broken down. This method of temporary filling locks up for the time being about two thirds of the ore in the stopes. The swell in volume of the broken ore over that in place being only about one-third. However, the two-thirds used for temporary filling could be drawn off after the work of stoping was completed, so that except for the time being no more ore used in filling would be lost.

This method would, in my opinion, be best calculated to meet the conditions existing at the Darien Mine.

The Electrolytic Production of Metals with Special Reference to Copper and Nickel.

Mr. TITUS ULKE, Sault Ste. Marie—Permit me to thank you for your kindness in sending me copies of discussion relative to "The Electrolytic Production of Metals, with Special Reference to Copper and Nickel," which you published.

I have only recently returned here from a nine-weeks' trip, inspecting the copper mines and smelting works of British Columbia, Washington, California, Arizona, and Sonora, Mexico, and have therefore not had leisure to write you before.

As regards Mr. Koehler's reply to my last stricture, I need hardly call attention to the fact, *re* 1, that Dr. Schnabel's classification is logical, while Mr. Koehler's is not, his explanation to the contrary notwithstanding.

Re 3. Mr. Koehler is finally compelled to admit my stricture, viz., "that the chloride method has, to say the least, not yet attained commercially practical prominence," and that there are grave difficulties in its way not encountered in the ordinary sulphate method of electrolytic refining.

Re 7. As the technical press and leading experts view my process with unqualified favor, and as the novel features thereof are covered by broad patents, or pending applications for same, I need not further discuss the merits of my process.

The printed discussion, I take it, has fully borne out the merits of my contention and friendly criticism of Mr. Koehler's interesting paper, which I could not well pass over without noting the few inaccuracies cited.

Safety Lamps and Colliery Explosions.

Mr. JAMES ASHWORTH, Chaddesden, England—In reply to the discussion on this paper in your journal of the 30th of September, I agree with most of the conclusions arrived at by Mr. Blakemore, of Montreal, and Mr. Hardie, of Lethbridge.

It is quite possible that the explosion at Fernie was initiated by the failure of a Clanny lamp, but it is *impossible* for an explosion within any safety lamp to "shatter" the lamp, and it is also impossible to even open the seam of a gauze by an explosion within the lamp if it has been made with any ordinary care. A lamp might fail and then be broken by a fall of roof, but even this is not of one of the likeliest of possibilities, because the point where an explosition originates is the one from which the destructive forces radiate, and is therefore the centre of compression, and no force passes over the lamp—it may in fact be said to be immersed in the force. Sometimes there is evidence of the "back lash" of the explosion when the vacuum resulting from condensation comes into play, and under this condition a lamp in a main road might be knocked about, but it would show that the force which smashed it was operating from the outside and not from the inside.

There cannot be a doubt in the minds of people who have seen fine coal dust ignite inside a safety lamp, that it will do so more readily than firedamp, and also that as the particles are so small as to pass through the mesh of the gauze, flame from the ignited or incandescent coal dust may be produced outside the gauze and be the cause of a disaster even without an explosion within the lamp.

Both Mr. Blakemore and Mr. Hardie recognise this risk as a valid and dangerous one, and about which we require more information.

Mr. Blakemore considers the use of benzolene in safety lamps as