concentrated *supers*, and the rapidly increasing demand for fertilizers by all the civilized world, both the new and the old, will tend to maintain a fair value for natural phosphates. We are getting into the era in which steam does not work fast enough, and on every hand we are seeking to accomplish our ends by electricity with lightning speed. Some one has said that the man who could make two blades of grass grow where one only grew before, was a benefactor to his race, but the rush and struggle for existence imposes that every cultivator shall be a benfactor in this regard, and carry on agricultural science at the highest possible tension for his very existence.

With increasing populations, with better means of transport, and lastly, but not least, advanced scientific education, fertilizers and all other artificial means of stimulating our exhausted soils will continue to be in increasing demand.

We see no reason therefore to suppose that the mineral phosphate industry or phosphate mining has attained its zenith, and so far as we can see at present, the future demands of the world for phosphoric acid are destined to increase with time and agricultural progress.

Resume.

We may now shortly generalize the foregoing facts and observations.

Of the sixty-four elementary substances at present known to compose the material of our original globe, phosphorus is found to be among the twenty more abundant elements, and is recognized to have been widely disseminated in all the original and ancient rock masses. With the exception of the segregations of crystallised apatite in the Laurentian rocks, we do not find any marked local accumulation of phosphatic bases in any of the azoic formations, or intrusive rocks.

The existence of the Eozoon Canadense is still debatable, and it is problematical whether the apatite of these older metamorphosed strata is not the mineralised product of organic remains, but passing from the Laurentian epoch to the succeeding and less altered rocks, we are immediately in presence of abundant evidence of organised life, and cannot fail to remark how much more frequent are the accumulations of phosphatised beds.

The function of organised life to assimulate and concentrate the disseminated phosphoric element is strikingly apparent. The natural forces which are ever restless and continual in building up the varied geological strata of succeeding epochs (attrition, deposition, cementation, ablation etc.) may alter and vary the manner of presentation of the phosphatic deposits which we have been considering, but the silently working power of assimilation by the organised cell would appear to triumph over the mighty disruptive and more violent operations of nature, for the latter forces fail to redisseminate the work accomplished by the former, but rather complete the task required to secure to man the providential supplies of phosphatic deposits with which we may satisfy our present demands, and therefore these economic supplies are seen to be chiefly in the more recent geological formations.

"A New Use For Old Ropes."*

By Robert M'Laren.

It has long been a source of anxiety with mining managers what to do with winding ropes which have been thrown off, as they can be used for few purposes about a colliery; and the price received when disposed of is so small that, rather than sell them, they allow them to lie about as so much useless material, probably with the hope that a use will be found for them some future day.

Owing to the difficulty in disposing of some old iron winding ropes, taken from No. 1 Pit, Gilmerton, at a remunerative price, the manager, Mr. Hutchison Burt, determined to utilize them on an incline, or "cran brae," in place of iron rails and wooden guides in use on the other inclines.

The colliery is situated to the south-east of Edinburgh, and is owned by the Gilmerton Gas Coal Co., Ltd.

The shaft (No. 1) is sunk to the Stairhead coal, at a depth of 88 fathoms.

From the shaft crosscut mines are driven east and west. On the west side the following seams are intersected in their order: Gillespie coal, Blackchapel coal, Coalpatty coal, Stinky coal, Glass coal, North Parrot coal, Corbiecraig coal, Peacocktail coal. The mine to the east side cuts through the Great coal seam. Six of these seams are presently being worked. The measures are in the carboniferous limestone series, and are highly inclined, the inclination varying from 65 deg. to 78 deg. The coal from the various seams is lowered to levels by inclines in cages or carriages. There are five inclines in operation—three with wooden guides and cages, one with iron rails and carriages, and one (Corbiecraig) with wire ropes and carriages.

Corbiecraig incline is 96 yards long, with eight stopping places, 11 yards apart, worked by a drum at the top, 6 ft. diameter, with brake attached, and steel haulage rope ⅝ in. diameter. The signalling is the usual method adopted in the steep measures. The inclination is 72 deg., except 30 yards or so at the top, which is 65 deg. On this incline the Corbiecraig coal and the North Parrot coal, about 8 yards back, are lowered. The latter is reached by back mining.

The Corbiecraig coal is worked stoop and room, stoops 20 yds. on level by 8 yds. to rise, with openings 9 ft. wide; and the North Parrot coal is worked long-wall.

Roadway.—The road is 12 feet wide by 4 ft. 6 in. high (average), and has a carriage and back balance way. Sleepers, 9 ft. by 8 in. by 3 in., are laid across every 4 ft., and on these are fixed planks 6 in. broad by 2 in. thick, laid longitudinally. Again, on the longitudinal planks the ropes, 3 in. circumference, are laid, and to make them rigid the following method is adopted:—At the foot of the incline a beam, 9 in. square, is fixed. Into this a hole is bored, and the rope is passed through, and is glanded on the under side of the beam. At the top the rope is fixed to a screw by means of a hose and muzzle, and as the screw is turned the rope tightens. As soon as the rope is stretched spikes or large nails are driven through its centre to fix it to the plank. The spikes are 8ft. apart.

The gauge for the carriage way is 4 ft. 6 in., and for the back balance way 1 ft. 10 in.

Carriage.—The carriage is 10 ft. long by 4 ft. 3 in. broad by 3 ft. high, is of angle steel, 2 in. by ¼ in., and carries one tub. The wheels are made with a groove 1 in. deep to fit into the rope, and are 5 ft. apart.

The speed of the carriage is twenty seconds for the journey from top to bottom, equal to 9·75 miles per hour; but the average is about half that speed. The weight of the carriage when loaded is 13 cwts.

Back Balance.—The back balance consists of a plank fixed to two axles, on which are wheels, same as on the carriage, and loaded up to the required weight. This back balance is insufficient for the part of the roadway which has the reduced gradient, and in consequence a second back balance is in use, which rests on a block, and is raised by the main back balance when ascending, and stops at the block when descending.

The second back balance is similar to the main back balance, except that is fixed a projecting piece of wood each side, 6 in. square, which come against the block, and the back balance is brought to rest. The block consists of two planks, 9 in. by 3 in, placed upright and firmly fixed between roof and floor.

To prevent the back balance when at rest from going over the block and tumbling down the incline, there is fixed a small pulley over which the haulage rope passes. The pressure of the rope on the pulley is sufficient to keep the back balance in its place, but, in case the rope should rise, two glands, raised in the centre are fixed close to the pulley, and the rope runs through them.

The incline has been in operation about six months, and has worked very satisfactorily, having given no trouble, neither carriage nor back balance having once left the ropes.

The advantages claimed for this rope road are:—(1) It is much cheaper, as the ropes are of little value; (2nd) It is easier fitted up, and, when compared with a similar incline fitted with iron rails, the cost is about one-sixth.

Discussion.

The PRESIDENT remarked that this was a paper describing another source of economy in coal mining, which seemed to work satisfactorily.

Mr. FAULDS asked if Mr. M'Laren would tell them if the ropes he described had many broken wires projecting out, or were they just slightly worn?

Mr. M'LAREN said he had not travelled the incline, but the manager, Mr. Burt, was there, and could doubtless answer the question.

Mr. BURT said he did not think the ropes contained any broken wires. They were ropes that had been at the colliery for four years.

Mr. MENZIES, former manager, said he was under the impression that the ropes had not worked for six months. They were good ropes, but got cut on a pulley and were put aside, and he had no doubt these were the same ropes.

Mr. M'LAREN.—In that case they were useless for winding, and therefore old ropes.

Mr. MENZIES.—Most certainly.

Mr. FAULDS said he would like to know how long the ropes had been in use, and whether the wheel was malleable iron, cast iron, or steel, grooved or otherwise.

Mr. M'LAREN said the wheels were grooved wheels, and similar to the ordinary winding pulley.

Mr. GEORGE THOMSON said, as one who had had some experience of steep workings, he thought Mr. Burt had great credit for the idea he had brought out. Especially where the inclination varied, he knew that it was scarcely possible to keep ordinary rails in their position unless they used a heavy rail, which was very expensive. Mr. Burt's idea was a new one, and he thought, a correct one, even though new ropes should require to be applied. He thought that a spike every 4 feet would be better than one every 8 feet. However, they would find that out by experience.

Mr. FAULDS said with grooved pulleys he did not suppose it would matter whether it was 4 or 8 feet.

Mr. HUGH JOHNSTONE said he thought it was a good idea to have practically continuous rails. This arrangement got over a difficulty which he had experienced when at Niddrie. He had no doubt if their wire rope friends took up the matter they would get over the difficulty of the broken wires by substituting a rope for the purpose.

The PRESIDENT said the use of old wire ropes in this way would depend on whether the price they got for them was more or less than the price of rails.

Mr. M'LAREN said the price of old wire rope was 20s. per ton.

The PRESIDENT proposed a hearty vote of thanks to Mr. M'Laren for his paper, which was agreed to.

*Transactions Mining Institute of Scotland.

The Speakman Water Cartridge.

In a paper read before a recent meeting of the Federated Institute of Colliery Managers, Mr. J. J. Speakman said:—

There was no direction in which improvements had been greater or attention more fixed than in that of explosives. After carefully examining the results of the many tests that had been made, it seemed not too much to say that amongst them the water cartridge, as used with gunpowder, might be fairly classed amongst the safest types. The comparative ease and safety with which colliers could handle gunpowder (which for so long a time was almost the only explosive), its freedom from gases injurious to health, the completeness with which the water extinguished the flame when the cartridge was properly made and placed in the hole, and, above all, the generally correct estimate a collier could form of the quantity required in a shot so as to yield the largest quantity of round coal, seemed to point to gunpowder being reinstated in the estimation of mining engineers and becoming again almost the sole explosive used in mines. Many and various experiments had been made for the prevention of flame as produced from ordinary charges for bringing down coal to that of the blown-out shot, and to avoid its coming into contact with fire-damp and coal dust. The greatest advance towards safety in coal mining was due to the discovery made by Sir Frederick Abel of using explosives enclosed in a water shield, now known more particularly as the water cartridge. The lecturer was inclined to give Mr. Tonge, who read a paper on the subject before the Manchester Geological Society in 1880, the credit of the invention and use of tin cartridges, and although at first they were not successful, they were used successfully afterwards. Captain M'Nab took out his patent in 1876 for the paper-bag cartridge, which, when used in a proper manner did good work, but did not supply the long-felt want. Mr. Miles Settle designed a tin cartridge, but it was rather cumbersome, and the difficulty of manipulating it militated against general adoption. Mr. Speakman now submitted a tin cartridge, which, he said, answered every purpose, and was probably the best water cartridge which had yet been before the notice of the public. It was simply worked, and thus enabled every miner to be in the position at any time to use it himself, without the assistance of the shot-firer. A series of tests were recently made at the Bedford Leigh Collieries, near Manchester, in the presence of a number of mining engineers connected with the neighbouring pits, as well as Mr. Saint, Her Majesty's inspector of mines. In these tests the explosive charge used in the cartridge was tonite, and four shots of four ounces each were fired in coal. The experiments were satisfactory, as there was an entire absence of flame, and the coal was brought down in excellent condition. The charge of explosive when in the cartridge lay in such a position as to be almost completely surrounded by water, and by thus placing the charge in the bottom of the cartridge it was claimed that there was a greater head of water for extinguishing any flame that might arise when the charge exploded.

In the discussion which followed, several gentlemen pointed out that it had been proved that under no circumstances could the flame from gunpowder be prevented by water.

Foreign Coal Used at the Government Cartridge Factory, Quebec.

(*Proceedings House of Commons.*)

Mr. McMULLEN—I see that 290 tons of coal are charged for the cartridge factory at $6 a ton, with so much for duty. Is this American coal?

Mr. BOWELL.—I do not know. All the coal was purchased by tender. I do not know whether it is American or Scotch coal.

Mr. McMULLEN.—Is it American coal or Scotch coal? There is $196 duty paid, and we would like to know whether it is coal from Nova Scotia or coal from the United States?

Mr. BOWELL.—Does not the hon. gentleman think that question a little captious? If it were Canadian or Nova Scotia coal, certainly the duty would not be there. It must be either English or American coal.

Mr. FORBES.—Where is this coal delivered?

Mr. BOWELL.—In Quebec for the cartridge factory.

Mr. FORBES.—Then it is not Nova Scotia coal?

Mr. BOWELL.—Certainly not.

Mr. FORBES.—Why is it that the department does not use Nova Scotia coal?

Mr. BOWELL.—Since I have been at the head of that department I have always instructed the deputy to accept the lowest tender.

Mr. FORBES.—Then I am to presume that American coal, with the duty, costs less than Nova Scotia coal?

Mr. BOWELL.—You may presume what you like.

The Quebec Asbestos Mines Re-open.—Advices from the Eastern Townships report that the asbestos mines at Thetford and Black Lake, which have been closed since November last, resumed working during the month.