weighing 2 tons 15 cwt. was let loose from a point 56 feet up an incline with 1 foot 6¼ inches rise. It ran down this incline and 57 feet along the level line at foot of same, or a total distance of 113 feet. The force expended was therefore 6,160 lbs. falling through 1.521 etc., feet, or 9,364 foot-lbs. The average frictional resistance was 9,364 ÷ 113, or nearly 83 lbs., equal to 30.5 lbs. per ton. A similar car fitted with roller bearings being let loose from the same point, ran the full length of the level line available, namely, 320 feet, and had not then quite come to rest, the total distance traversed being 376 feet. The force expended was as above, 9,364 foot-lbs. The average frictional resistance was 9,364 ÷ 376 = 24.9 lbs., or about 9 lbs. per ton of load. A saving of 70 per cent. Relative starting effort of a tramcar on a gradient of 1 in 20, ordinary bearings 100, roller bearings 77, saving 23 per cent., ditto, ditto, on a gradient of 1 in 80, ordinary bearings 100, roller bearings 50, saving 50 per cent., ditto, ditto, on a gradient of 1 in 140, ordinary bearings 100, roller bearings 39.6, saving 60.4 per cent.—results which require no comment. Perhaps one of the most interesting amongst the general applications of these bearings is that of the big bell at St. Paul's Cathedral, "Great Paul," which with its headstock and other moving parts weighs nearly 25 tons, and which gave considerable trouble when mounted on ordinary bearings. The following results are instructive: When mounted on the ordinary bearings the bell came to rest—after the swinging effort had been discontinued—within one minute, when on roller bearings in 6 minutes 55 seconds, showing that the frictional resistance of the latter was only about one-seventh of the former, a result remarkably in accordance with the starting effort tests given under the head of "Tramways." With reference to the question of heating it is an interesting fact that there has not been a single case of a hot bearing in all the experience so far gained with roller bearings.

Although it is somewhat early to predict what the cost of maintaining these bearings will be, the results so far show that if they are constructed of suitable materials, it will be extremely low; 60,000 miles in railway work and over three years in tramway work, with but very slight wear are most encouraging. It has been found that polished compressed steel is the best material for the rollers, cast steel for the cases in railway and heavy shafting bearings, and hard cast iron for tramcar and other lightly loaded and slow-running bearings.

WE have been compelled to hold over a quantity of interesting matter, including a report of the meeting of the British Association for the Advancement of Science, held in Toronto last month.

UNUSUAL MINING.*

BY J. T. DONALD.

Lac a la Tortue (Turtle Lake), 21 miles from the city of Three Rivers, on the Piles branch of the Canadian Pacific Railway, is a very curious iron mine, worked by the Canadian Iron Furnace Company, which operates a modern water-jacket furnace at Radnor, 10 miles distant. This lake is a body of water about four miles long by one and one-quarter miles in average width, occupying the centre of a large area of swampy land. The surrounding land is largely composed of sand formed by the wearing down of the Archaean rocks by glacial action. It is well known that decaying vegetable matter yields acids that dissolve the oxide of iron. Evidence of this solvent action of vegetable acids on iron are frequently seen in pieces of slate. The slate is colored by iron, but frequently white or light-colored spots occur. These are points where a leaf or a fragment of bark has been deposited with the fine mud, in which form the slate was deposited. The leaf or bark has decayed; the vegetable acids thus formed have dissolved the iron oxide to which the color of the slate was due, and of course a white or colorless patch is formed.

In the sandy area around Lac a la Tortue we find the most favorable conditions for the action of vegetable acids on iron oxide. The sandy land produces a rank vegetation, and its decay furnishes abundance of organic acids. These acids are in solution in the drainage waters, which on their way to the lake percolate through the sand. They thus come into contact with the iron oxide in the finely divided materials, dissolve it, and carry it along to the lake. Here a new chemical action comes into play. The solution of iron in vegetable acid (in which the iron is in what the chemist calls the form of a protosalt) is oxidized by the action of the air on the surface of the lake into a persalt, which is insoluble, and appears on the surface in patches that display the peculiar iridescence characteristic of petroleum floating on water. Indeed, not infrequently these films of peroxide of iron are incorrectly attributed to petroleum. These films become heavy by addition of new particles, they sink through the water, and in this manner, in time, a large amount of the iron ore is deposited on the lake bottom. It must not be supposed that the ore is deposited as a fine mud or sediment. On the contrary, in this lake ore, as it is called, we have an excellent illustration of what is known as concretionary action—that is, the tendency of matter when in a fine state of division to aggregate its particles into masses about some central nucleus which may be a fragment of the sunken wood, a grain of sand, or indeed a preformed small mass of itself. Precipitated in water, as our lake ore is, it of course has great freedom of movement, and we, therefore, find it in flat concretions, more or less porous and circular in outline; the general appearance amply justifying the term "cake ore," which is locally applied. These concretions vary much in size, some of them being no longer than mustard seeds, others 8 or 10 or more inches in diameter. Frequently the larger cakes are joined together and form masses looking not unlike batches of a certain kind of bun commonly exposed in the shop window of every confectioner, and made by coiling a strip of dough round and round a piece of itself.

The ore is not found over the whole lake bottom; it occurs along the whole margin, and also well out from shore where streams enter the lake, the distance of the ore deposit from shore depending, of course, upon the volume of water carried by the streams and the velocity with which it enters the lake. Certain strips of ore occur at a considerable distance from the shore, and in as much as 16 ft. of water. These deep-water, mid-lake deposits denote probably the courses of former streams which are now non-existent, owing to some change of level. The ore is extracted from this lake-mine by hand and by power; the shallow margins are worked by hand, while from the deeper parts of the lake the ore is raised by means of a steam dredge.

A short time ago the writer was instructed by the proprietors to make an examination of the lake-mine and report the quantity of ore in sight. From the description of the mine already given, it will be seen that the task allotted was a somewhat unusual one. A certain amount of planning and experimenting was necessary before any satisfactory method of getting at the quantity could be determined upon, but finally the following method was adopted, and found to work admirably:

A number of lengths of 1-in. gas pipe were coupled into one length of about 30 ft., and this, resting on the stern of a scow, was pushed down into the water until the end rested on the bottom of the lake. The scow was towed by a tug backward and forward over the whole lake. When an ore deposit was reached, its presence was indicated by the vibratory motion of the long pipe, caused by the end slipping from cake to cake of the ore. When no ore was at hand the end of the pipe slid smoothly along the firm sand, for fortunately nothing coarser than sand is found in the lake except ore cakes. When a deposit of ore had been located and its superficial extent determined as above indicated, the quantity of ore per square foot of each deposit was determined as follows: An iron tube about 2 1-2 feet in diameter was lowered from the side of the scow into the deposit and worked down until it passed through the ore layer into the sand beneath; then, by means of an implement like a telegraph spoon and by long-handled tongs and grappling irons, all the ore within the area of the tube was brought up to the deck of the scow, where it was examined and

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