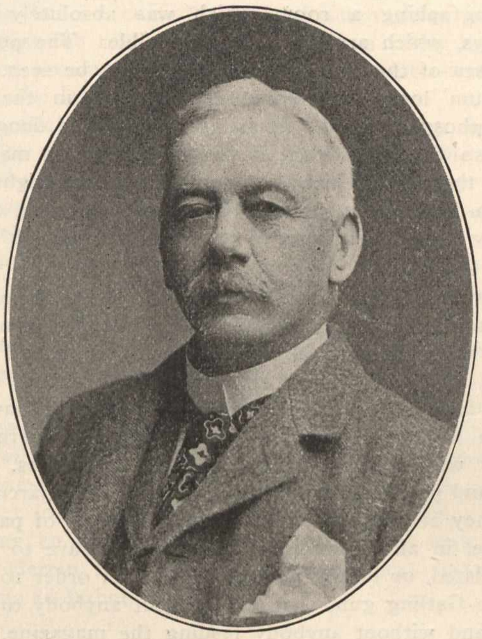
so that branches could be run up every country road at small expense. A natural development from this would be the use of electricity by farmers wherever it would pay, including the taking of their produce to market. On one line in France the amount of power used is one kilowatt-hour per car mile, costing there five cents. Repairs, wages and general expenses bring the cost up to eleven cents per car mile. There are places where the trackless experiment might well be tried, but we are convinced that the trolley on the track is the thing we have to look to in Canada, and it is fair to remark that as compared with some parts of the United States the development of it in Canada is very slow.—Montreal Witness.



JAMES COOPER.

The death last month from cancer of the stomach, of James Cooper, head of the James Cooper Mfg. Co., of Montreal, came as a shock to those connected with the engineering, mining, and contracting trades, among which he was so widely known. Mr. Cooper had a long and honorable business career. He was first employed in the old hardware firm of Rice Lewis & Co., Toronto, and afterwards with Frothingham & Workman, of Montreal. In 1872 he started in business for himself in Montreal, and soon afterwards took in Frederick Fairman as a partner, when the firm became Cooper, Fairman & Co., dealers in heavy hardware. Mr. Cooper's firm soon became interested in manufacturing, and established one of the first barbed wire factories in Canada. This branch was gradually developed until it was formed into a distinct corporation under the name of the Dominion Wire Manufacturing Company, of which he was president. The firm in this connection took up a patented machine for making wire rope and formed what is now the Dominion Wire Rope Company, of which Mr. Cooper was also president, and then followed the formation of a company to manufacture patented pipes and elbows, of which he was also president. The firm next took up the manufacture of mining machinery, operating this as a separate branch or department until it grew to such proportions that it was formed into a limited liability company, under the name of the James Cooper Manufacturing Company, of which he was president. The firm also held the controlling interest in what is the present Dominion Bridge Company. This control was held up to the time of the dissolving of the firm of Cooper, Fairman & Co., in 1889, since which time Mr. Cooper has remained a director of the company. In addition to his many company interests, he did a very large trade in railway supplies and contractors' supplies, representing such English firms as Chas. Cammell & Co., Sheffield; John Hendry Andrew & Co., Sheffield as well as large American manufacturing concerns.

It was Mr. Cooper's intention to have converted his private business, which he had personally conducted with such marked success, into an incorporated company; and the letters patent for same had only been completed a week before Mr. Cooper's death. The formation of this new company will now be carried out by the executors.

ABOUT THORIUM.

The McGill University Magazine contains an article by C. F. Soddy, on the discoveries recently made at McGill by Professor Rutherford and himself. The article describes radioactivity as the property of spontaneously giving out rays similar to the X-Rays. This property is possessed by uranium, thorium, and to a very much greater extent by radium. Thorium and radium, but not uranium, were found to be continuously giving off, besides the rays, a gas of no chemical affinities and infinitesimal quantity, whose existence can only be ascertained by the fact that it gives out rays, like those of the substances from which it comes, making the air conduct electricity. The actual material character of these gaseous emanations was established recently with the aid of liquid air, the emanations being condensed and found to boil off at a temperature of 130 degrees Centigrade. This was discovered with the aid of electrical measurements inconceivably minute.

The most delicate balance in existence is at its extreme limit in dealing with quantities of one millionth part of a gram of water. The spectroscope is reputed to be able to detect less than one-thousandth part of this quantity in the case of certain substances. But the electrometer, which is the instrument used to measure the electrical conduction produced by the rays, and, therefore, the matter itself causing those rays, altogether exceeds even the spectroscope in sensitiveness. How far, mere figures would convey no idea. If 1,000 grams of thorium produced the thousandth part of a gram of emanation in a million years, the amount from one gram in one second could still be, as it actually is, easily detected by the electrometer from the rays it emits.

Mr. Soddy's article, however, goes on to state that the rays from the emanation from these substances do not go on forever, like those of the original substances, but decay rapidly, and disappear. They leave, however, an invisible film of a radioactive substance on any solids with which they come into contact, and this film, though invisible, can be scraped off with sandpaper and dissolved in acid, where it continues to give off rays, which gradually die away, but the substance can be traced through two more metamorphoses before it finally becomes inert and impossible to detect.

Another wonderful thing is that though thorium is an element, yet all its radioactivity can be concentrated into a very small part of it. If ammonia is added to a thorium solution, the thorium is precipitated in a very inactive condition, while a very little remaining in solution keeps all the radioactivity. This, however, like the emanations, loses its activity gradually, while the rest of the thorium regains its activity at exactly the same rate. When it has recovered, another precipitation will again divide it into active and inactive portions. The active portion is called thorium X.

Then comes the task of explaining by what process a chemical element like thorium may come to be the progenitor of five new forms of matter by successive changes spontaneously and continuously. An element on accepted chemical ideas is a substance so far homogeneous that it consists of a very large number of separate parts of atoms, each of which is exactly like every other.

The separate atoms form the unit in all changes till now observed, and hence, atoms are generally looked on as indivisible, which is not quite the same thing. Radioactivity has introduced us to the new kinds of change, so that now it is no longer possible to consider the atom as the unit. But the moment the atom is also regarded as composed of parts, each perhaps with a definite motion of its own—inside the system, it is easy to see at least a possible mechanism by which an element could undergo slow spontaneous change.

Suppose that the thorium atom were a similar system, what would be the result? Out of the myriads of atoms that go to make a single gram of thorium, several, if not several millions might break up every second by coming in