been found capable of being converted into explosives by nitration, it only remained to try an experiment on the original materials, coal and peat. Wood was excluded from the list for its conversion into an explosive (pyroxyleine) had already been accomplished by Trauzl. It was found that the direct conversion of coal into an explosive by extracting the nitro-products, would involve very expensive and tedious manipulations. After numerous unsuccessful experiments, in which the product was either completely burned up, or the coal was but slightly acted on, we were induced to try a gradual nitration. The coal, in form of a fine dust, was first treated with weak nitric acid, specific gravity 1·40 to 1·48; the weight of acid required was ten times that of the coal used. When stone coal was introduced slowly into the acid the rise in temperature was inconsiderable, and some hyponitric acid was formed. The action was much more violent in the case of brown coal, and least so with wood coal. After the operation with any coal, a large portion of the material to be nitrated remained apparently unaffected, and formed a thick sediment on the bottom of the vessel, while the nitro product was dissolved in the acid layer above and imparted to it a light brown color—with brown coal nearly a black color. When this fluid layer was well washed with water, the nitro product was thrown down as a fine brown powder. This precipitate was filtered out, and washed repeatedly until the wash water was no longer acid. The sediment was also washed several times to remove the exhausted acid, then dried and finally treated with the most concentrated acid. It separated into two layers, the liquid one was treated just as before described, to obtain the nitro product suspended in it. Again the precipitate was brown, either light or dark. The solid residue was again washed and dried, then treated with the most powerful nitrating agents. In this way we succeeded in converting nearly all the brown coal and stone coal into nitro bodies, as well as the larger portion of the wood coal.

The yield was scarcely sufficient to compensate for the large consumption of acid, especially with the wood charcoal and coke. All the nitro products obtained are nearly alike in color, state of aggregation, and other properties. They are insoluble in water, soluble in alcohol, and the most concentrated in nitric acid, and burn with strong aromatic odor. They are heavier than water.

The results of experiments made on peat were considerably more encouraging, different kinds being tried. A firm, solid kind called "bog peat" (*Moortorf*), from Lüneburg, was tried after a smalltest had shown that the reaction would not be too violent. It was first subjected to the action of equal parts by weight of the strongest nitric and sulphuric acids for several hours. The substance changed color from dark brown to dark red. Ignited in the air it burned with a lively flame and strong, aromatic odor. When soaked in a solution of chlorate of potash and dried, it formed a powerful explosive. If the same peat was well pounded before the nitration so that the humus substance was separated from vegetable fibers, and a larger surface was exposed to the powerful action of the acids, the earthy humus constituents were converted into a dark brown liquid, sticky nitro-body, have the external characters of that obtained by nitrating the heaviest tar oils. Its action when mixed with oxygenated bodies is also just like the latter. The other nitro substance, formed from the finely divided fibers left in the dry distillation that attends the formation of peat, yields an explosive without any admixture of an oxygen-bearing salt. In the open air it burns very rapidly, leaving a slight carbonaceous residue.

Peat containing animal admixtures acts just like this bog peat. Peat that seemed to be of later formation would not bear the action of concentrated acids. There was a violent evolution of hyponitric acid, and in spite of the most careful cooling the heat became so great that there was danger of its reaching the ignition temperature of the nitro-derivative, so that the process had to be interrupted. The same peat was then mixed with ordinary commercial nitric acid, specific gravity 1·35, and as the action of this acid was scarcely perceptible, concentrated acid was gradually added until the process began to be quite violent. The acid had then been brought up to a gravity of 1·45. After the reaction had gone on for several hours with careful cooling, the product was washed and dried. This is also an explosive without the admixture of the oxygenated body, but not so strong as that made from bog peat with the stronger acids.

Others of the newly prepared nitro derivatives, especially those from the crude tar oils by repeated nitrations, form explosives alone; but they are always weaker than when mixed with oxygenated bodies.

The manufacture of explosives from peat, owing to the cheapness of the material and its wide dissemination, as well as the simplicity of the process, is doubtless an important step in advance.

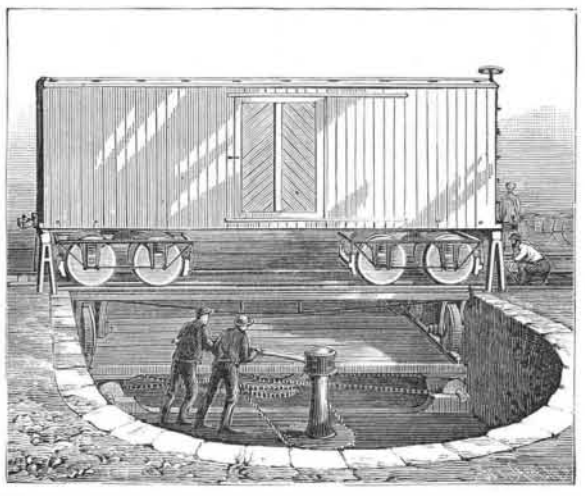
The chief characteristics of the newly-prepared nitro-substances are the following: The specific gravity of all is very nearly that of water. They all possess a powerful aromatic odor, resembling the fruit ethers, which is particularly noticeable on burning them. All solutions of these substances have a strong refractive power. The greater part of them are soluble in the strongest nitric acid, as well as in alcohol; they are all insoluble in water. In the open air they all burn with a bright, but more or less smoky flame. Their molecules are so slightly united that they can be exploded alone or mixed with oxygenated substances, by simple ignition.—*Deutsche Industrie Zeitung*, No. 36.

The Microphone and Fire Damp.

A new application of the microphone to the determination of the position of nodes and ventral segments in columns of vibrating air has been communicated to the Academy of Sciences by M. Lerra-Carpi. The microphone is mounted on an elastic membrane stretched over a little drum, and then lowered into the sounding pipe. When the apparatus came to a node, the telephone in circuit with the microphone gave out a rumbling sound, similar to that caused by an induced current. On the other hand, when the microphone passed a belly the sounds become very faint and rare, while at intermediate points they increased or diminished according as the microphonic sounder was brought nearer to a node or a belly. It is believed that the microphone may thus be made useful as a detecter of fire damp in mines. According to some observers such explosives are always preceded by undulations too feeble to be detected by the human ear, but these latter would be revealed by a system of microphones placed at intervals through the mine.

APPARATUS FOR CHANGING CAR TRUCKS.

The engraving shows a novel device for facilitating the changing of the trucks of railroad cars when the cars are to pass upon a track of different gauge. The invention consists of a platform or frame raised and lowered by means of eccentrics, and provided with rails corresponding with stationary rails placed at a lower level than the rails of the main line and sliding tracks, and at right angles therewith, and carrying a transfer-truck to receive and carry the car trucks. In combination with the eccentrics carrying the



ATKINSON'S APPARATUS FOR CHANGING CAR TRUCKS.

platform or frame there are chain-wheels, chains, and a capstan, by which the eccentrics can be readily operated to raise and lower the truck receiving the platform or frame.

By means of this apparatus a train of cars can be transferred, or all of the trucks changed, without disconnecting the train. All that is necessary to do is to back the train over the apparatus and transfer the trucks in the manner illustrated by the engraving.

This invention has been patented by Mr. Geo. W. Atkinson, of Petersburg, Tenn.

Cotton Manufacturing in the South.

The development of cotton manufacturing in the South is one of the most notable and promising industrial occurrences of the day. Not merely because of the rapid growth of the business, but more because of its appropriateness and apparent profitableness. The conditions would seem to be altogether in favor of the Southern mills, so far as the supplying of their home market is concerned at least, and it remains to be determined whether they have not also marked advantages in the competition for control of the markets of the West. The larger part of the charges for freight, jobbers' commissions, storage, insurance, etc., which the Eastern mill owner has to pay, the Southern mill is exempt from; and the difference from $2 to $3 a bale in freight alone is clear saving.

The Baltimore *Journal of Commerce* estimates the actual capital now invested in Southern cotton mills at $50,000,000, of which nearly one-third has been invested within two years.

Touching the prosperity of these Southern mills the *Journal* says that ten per cent annual dividends are the lowest reported, and this after a large amount has been taken from the earnings for increasing the size and capacity of the mills. Under more favorable conditions the dividends have been much larger, as in the following instances:

The Augusta, Ga., factory, the oldest mill in that city, has a capital of $600,000, and runs 26,200 spindles and 790 looms; from 1865 to 1882, 17 years, it has paid out in cash dividends $1,467,000, or about 2½ times its capital, or an average of 14½ per cent per annum; besides this it has laid aside a surplus of between $340,000 and $350,000, or over 50 per cent of its entire capital; its stock is worth from 160 to 170. The Langley mill of the same city has a capital of $400,000, with 10,000 spindles and 329 looms; it has paid in the past 3½ years 47½ per cent dividends, or an average of about 15 per cent per annum; last year it paid a dividend of 20 per cent; its present surplus is $200,000, and its stock is worth from 160 to 170. The Graniteville mill, also of Augusta, with a capital of $600,000, has 34,600 spindles and 900 looms; this company pays 10 per cent dividends, and then puts its surplus into new spindles; out of its surplus earnings, that is, its earnings above its dividends, it has built, without a dollar's expense to the stockholders, the Vaucluse mills, with 10,000 spindles for making fine fabric, at a cost of $340,000; it has also laid aside an additional surplus of $125,640. The Enterprise was started in 1877, with a capital of $900,000; it has also paid 10 per cent dividends, and laid aside the rest of its earnings as a surplus. The Wesson mills of Mississippi have paid a dividend of 26 per cent, and the Troup factory of the same State 24 per cent, while from time to time we have noted dividends of from 30 to 50 per cent, the latter having been earned by a Pulaski, Tenn., mill last year.

Against this, by way of comparing the relative profitableness of Northern and Southern mills, is set the assertion of Mr. Russell, Member of Congress from Massachusetts, who said in the House of Representatives that he had from official sources a statement showing that fifty of the leading corporations in Lowell, Lawrence, Chicopee, and Salem, Massachusetts; Manchester, Nashua, and Newmarket, New Hampshire; Lewiston, and other points in Maine, representing a capital of $50,000,000 engaged in manufacturing the various grades of cotton and woolen fabrics, have paid to their stockholders in the last five years an average dividend of a little less than 7 per cent per annum only.

The cotton mills of the South already give employment to something like 40,000 operatives.

Georges Leclanche.

On the 14th of September, 1882, at 7 P.M., Georges Leclanché died at Paris, at the age of 43 years, a man universally well known and esteemed, the inventor of the peroxide of manganese battery. After leaving the Ecole Centrale des Arts et Manufactures de Paris, in 1860, Leclanché entered, as chemical engineer, the laboratory of the Compagnie des Chemins de Fer de l'Est, where he remained until 1867.

The year 1867 was the time of his first patent for peroxide of manganese batteries with a porous cell. He left the Compagnie to devote himself almost entirely to the industrial development of his idea, which he completed by a series of subsequent patents. Two of these new patents are especially important: that of 1873, relative to cylindrical agglomerate surrounding the carbon, and that of 1876, relative to movable agglomerate plates maintained against the carbon by India-rubber bands. Very limited at its commencement, the manufacture of Leclanché batteries is now almost monopolized at Paris by M. Barbier, employing 50 workmen, who manufacture at least 2,000 plates per day, and have turned out during the year 1881 about 280,000 elements.

At the present day complete elements or simply agglomerated plates manufactured at Paris are exported to all parts of the world. Leclanché batteries have penetrated everywhere; the recent invention of the telephone has given them a fresh impetus, and opened up an immense trade, of which the importance can scarcely at present be predicted; their increasing employment for domestic purposes, bells, calls, electric lamp-lighters, telephones, etc., has familiarized the public with electricity, and, to some extent, made way for more important applications. The capital invention of M. Leclanché will have been, therefore, at once a service and a benefit. His premature death in the full maturity of his intellectual power and of his chemical and electrical knowledge will be deeply regretted by all those who are interested in the progress and future of the applications of electricity.

Outside of his researches on batteries, which, to reduce them to a practical form, absorbed a large portion of his time, M. Leclanché was occupied with electric horology, and devised, to distribute the time to recording chronometers, a sure and ingenious system of simple contact, very little known, and applicable to a number of electrical instruments.—*The Telegraphic Journal and Electrical Review.*

The Atlantic Ocean Cable of 1869.

It is stated by the Anglo-American Telegraph Company that the Telegraph Construction and Maintenance Company, with their S.S. Scotia, have succeeded in picking up the Anglo-American Company's cable laid in 1869, between Brest and St. Pierre, in mid-ocean, in depths varying from 1,600 to 1,930 fathoms of water, and repairing the fault which occurred on the 18th March last. They have also repaired a minor fault at a distance of 335 miles from Brest, in a depth of 1,269 fathoms. The whole of the company's system of cables and land lines is now in perfect working order and condition.

Novel Fire Escapes.

The last invention for the protection of theater audiences is a "penetrable safety wall," which has just been patented by an engineer at Kottsbus, Germany. The plan is to make the interior wall in all parts of the theater of papier mache, made after a certain method. Such a wall will have the appearance of massive stone, but, by pressure upon certain parts where the words are to be painted in luminous letters, "To be broken open in case of fire," access to the exterior corridors is to be obtained, whence escape to the outer air can be made.