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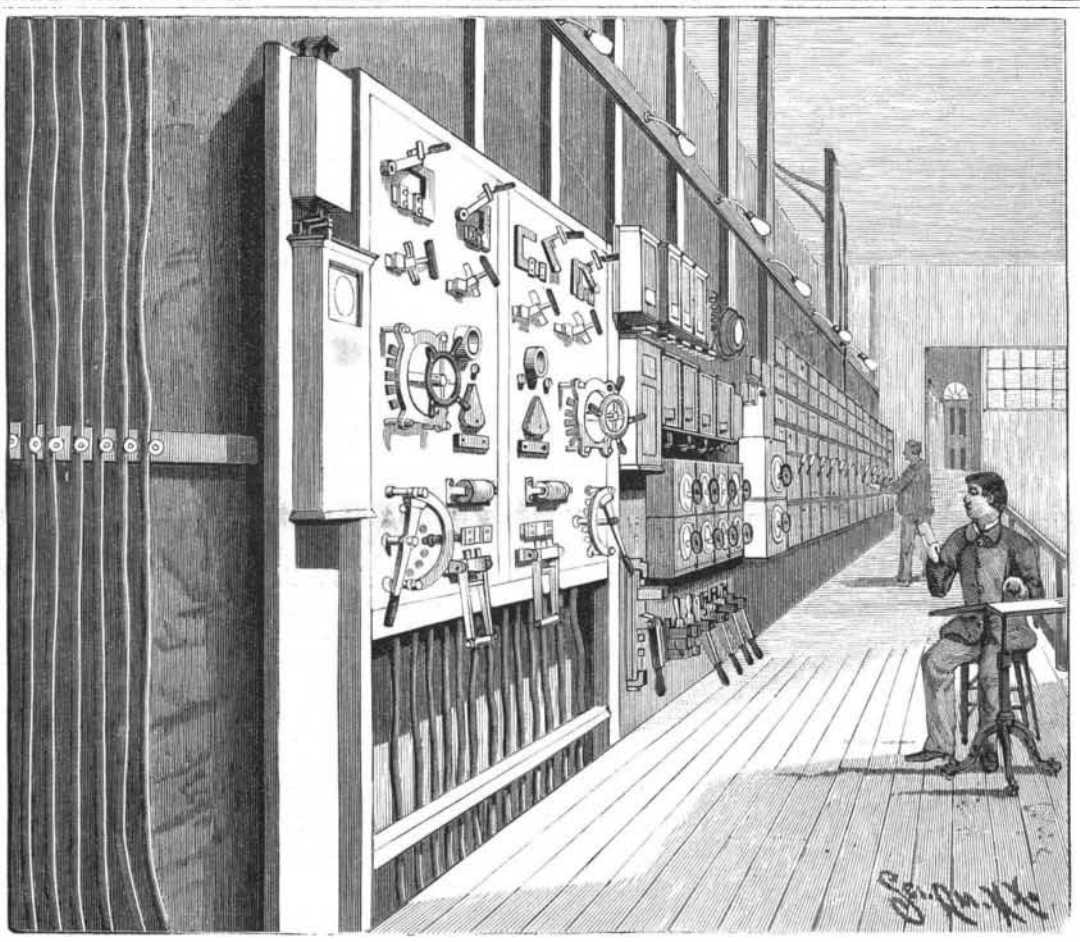
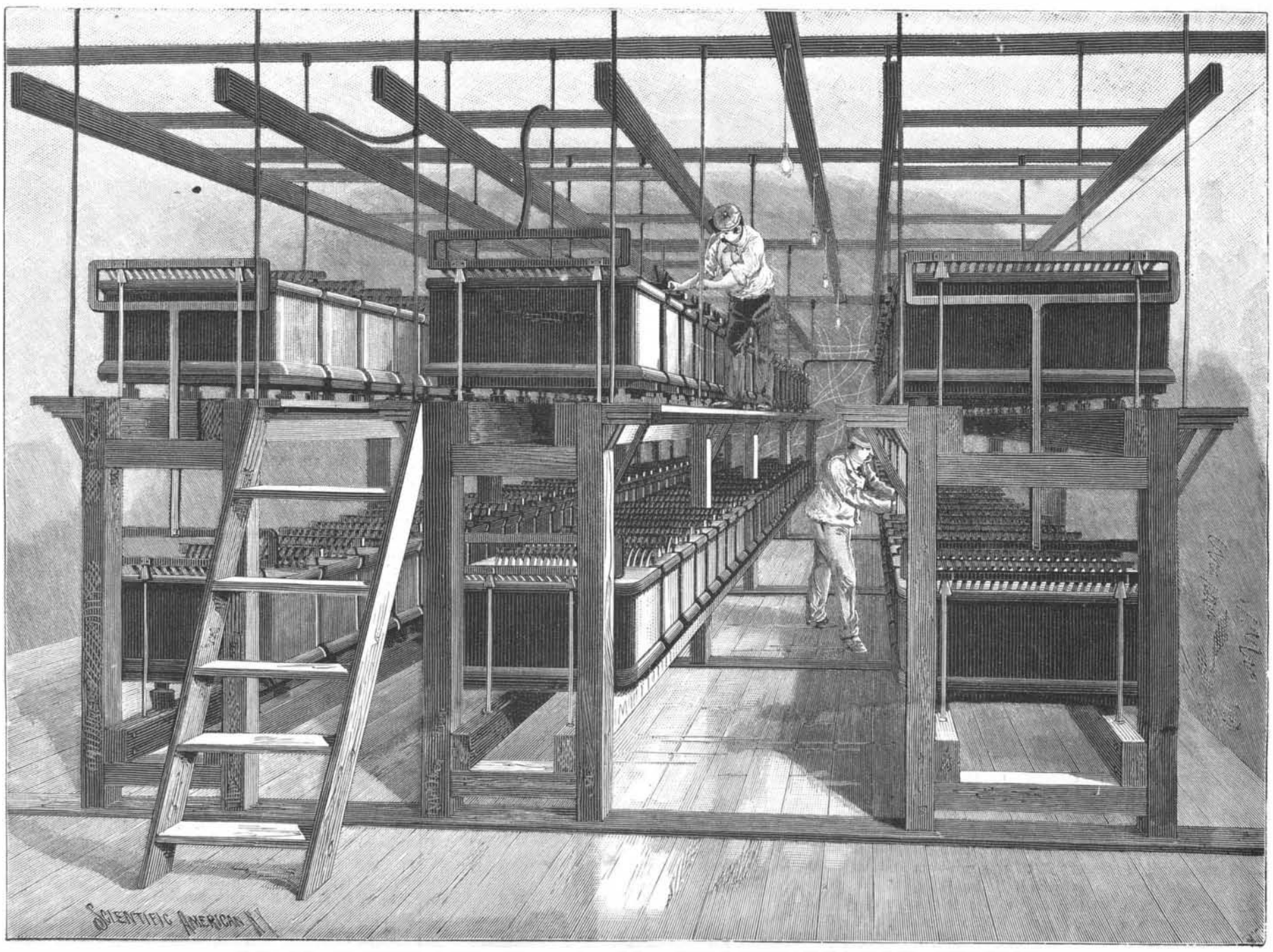
A STORAGE BATTERY FOR CENTRAL STATION SERVICE.

Since the invention of the accumulator by Gaston Plante, in 1860, many modifications of the original storage battery have been devised and put into use, most of them being more or less marked departures from the Plante form. Some years since, Mr. Howell, of the Crompton-Howell Electrical Storage Company, Limited, of London, England, made an important improvement on the invention of Plante, by producing lead plates having enormously extended surfaces, the lead being made in a form of sponge, the pores being of such a character as to permit the electrolyte to readily penetrate the interior of the plate. These plates were formed according to the invention of Mr. Plante, and the result was a storage battery of enormous capacity and great durability. This battery, which has been in successful continued use in England for five years, has proved of great utility in central station lighting.

Recently, this system was introduced into this country by the Edison Illuminating Company, at the 53d Street central station, where they are daily used to help out the dynamos when the demand for current is very great. They are also used for supplying current when the engines and dynamos are at rest. The charging is done when the dynamos would otherwise be running with a light load. This station is provided with two batteries, each consisting of a series of 70 cells of 61 plates each. One series is connected with the positive and neutral conductors of the three-wire system, the other series being connected with the negative conductor and the neutral conductor of the system. Each cell has a capacity of 1,000 ampere hours. These cells are each supported upon a board resting on glass insulators and their terminals are connected with heavy main conductors which are also supported on insulators. The containing cells are made of lead and all of the connections are massive. The cells are supported upon racks so as to be accessi-



THE SWITCHBOARD GALLERY, FIFTY-THIRD STREET STATION.



STORAGE BATTERY PLANT OF THE EDISON ILLUMINATING COMPANY, NEW YORK.

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ble. The porous plates are made by maintaining melted lead almost at the point of crystallization and then casting from the semi-crystalline mass blocks forming what may be called "lead sponge." This lead sponge, when sawed into plates of suitable size, forms the most reliable material that has been used in the manufacture of accumulator plates. The plates thus made and prepared are free from most of the defects which are inherent in most paste plates. The lead salts forming the active material, instead of being artificially made and mechanically applied to the plates in the form of paste, are formed chemically as a firmly adherent deposit on the greatly extended surface of the lead crystals and are therefore dispersed throughout the spongy material. When thus formed, it is impossible for the active material to become detached or fall off to any serious degree.

It has been found from actual practice that these plates are not injured by long use, that they have a great capacity of high or low discharge rates, and that they are entirely free from buckling.

The plates now in use at the Edison station have been doing continuous service for more than eight months, having been started in the middle of January. During this time only 21 out of 7,000 plates have had to be replaced.

The watt efficiency of these accumulators is over 86 per cent and their ampere efficiency 95 to 96 per cent. These efficiencies are accurately calculated at the terminals of the battery connections on the switch board.

These cells are the largest in use in this country. We understand that the Crompton-Howell Company make a still larger cell, comprising 154 plates and having a capacity of 3,000 ampere hours.

The battery room at the 53d Street station is located on the top floor, the electrical communications are made through the switch board at the gallery, and the attendant having charge of the gallery manipulates the switches for charging and discharging the accumulators. The switch board is provided with an automatic accumulator switch, which is used with the dynamo charging the accumulators. It is arranged to break the circuit so as to prevent reversal of the current, if from any cause the E.M.F. of the dynamo falls below the prescribed limit.

Besides being provided with the usual well known indicating and recording instruments the switch board is provided with an instrument called the electric clock, the index of which turns in one direction while the accumulator is being charged and in the opposite direction while it is being discharged, thus always indicating the amount of the charge.

We are indebted to Mr. William L. Pakenham, the representative of the Crompton-Howell Company in this country, for information in regard to this new installation.

The Physical Strain Involved in High Speeds.

The exaction that modern railroad speed makes on the physical stamina of railroad men is demonstrated in the fact that seven engineers are required to take the Chicago flier out and seven back, says the *Boston Transcript*. The running time between New York and Chicago is twenty hours and the average speed is forty-eight miles an hour. Each engineer and engine runs three hours. Machine and man return with a slow train to their starting point to relieve the strain on both. Then the engineer is given forty hours' rest before he goes on the flier again. This rest is absolute, no work of any kind being required of the engineer. Though the average speed is forty-eight miles an hour, the locomotive must at some points be driven at sixty or more. The physical strain on the men in the cab at those bursts of speed is something terrible. The engineer has fifty things to look out for, and is being shaken and swayed all the time. The fireman is constantly feeding the insatiate furnace. On the run of the Empire State express three tons of coal are shoveled from the tender into the furnace between New York and Albany. It is not wonderful that the engineers of this train are given alternate days for rest and recuperation. Fast travel not only wears out rails and machines, but human creatures' lives.

A Museum of Natural History for Chicago.

The Art Palace of the Columbian Exposition will be retained as a Museum of Natural History. A process has recently been discovered by means of which the staff covering may be made permanent by the application of a soluble glass paint. The proposed Columbian Museum was made possible by a gift of one million dollars made by Marshall Field, the millionaire merchant. There is material enough in the Fair grounds to start one of the most complete museums ever organized. The ethnological department under Prof. Putnam obtained $200,000 worth of specimens gathered in all parts of the world. This magnificent collection will be presented to the museum and will form the nucleus around which the later additions will be placed. Most of the rare woods in the Forestry building will also be presented to the museum. The new museum will be within easy walking distance of the University of Chicago.

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DEATH BY GAS ASPHYXIATION AND POISONING.

We recently had a case of death from gas asphyxiation brought to our attention by a letter describing the occurrence. The writer first tells of the features of the occurrence. In Corning, Kansas, a well was being bored. The depth was about seventy feet. A rock in the bottom interfered with the operation of the tools. A man undertook to descend the rope. When about fifteen feet from the surface, he dropped from the rope. His companion workman at once started to rescue him and descended the well, naturally supposing that his companion's grasp had failed him. When the second workman reached about the same point, he also fell. Both were ultimately removed dead. A lantern was lowered into the well and was extinguished, also at the fifteen-foot level. The people of the vicinity attributed the accident to fire damp. The real cause was choke damp or carbonic acid gas. Under the circumstances it could not have been the other gas. Our correspondent writes, "Will the SCIENTIFIC AMERICAN explain what the so-called fire damp is and what causes it?"

As we just stated, it was not fire damp. The cause of the presence of carbonic acid gas in the well cannot be stated with certainty. We know that many mineral waters are highly charged with it, so that it may be looked for in any deep excavation. It may have been liberated from some subterranean source of mineral water.

The gas in question is nearly twice as heavy as air. It can be poured from one vessel into another almost like water. Being a gas, it must constantly diffuse through air and air through it when they come together, yet it will lie in an open receptacle for a long time before entirely leaving it. An animal immersed in it dies of suffocation, with possibly a superadded toxic or poisoning action upon the system. A lighted lamp or candle lowered into it is extinguished as if dropped into water. The gas is without odor, so that one may be overcome without the least forewarning.

On November 3, 1886, a remarkable accident in a tunnel at Perkasie, Pa., occurred which illustrates the fearful suddenness of the attack. Some fifty men were working in the interior of a railroad tunnel. A freight engine had become "stalled" near them. A fan blower was set to work to bring up the pressure. The engine then started, and it is supposed acted like a piston, forcing the gas before it, and as the gas was driven on, it reached the place where the men were working; they at once became immersed in the deadly atmosphere. They fell as if dead, some forty of them becoming totally insensible. One man, only partially overcome, succeeded in making his way to the mouth of the tunnel and reported the occurrence. A flat car was at once run in, and was loaded with the bodies, as if with so many logs. All were supposed to be dead, but with the exception of one who had fallen into a pool of water, they eventually recovered. As a curiosity and as illustrating the suddenness of the insensibility, the fact that one man was found hanging head downward to a ladder may be cited.

Carbonic acid gas is to be looked for in confined places, and in beer vats, wells, and similar impervious receptacles. Before entering a suspected locality, a test should be applied by lowering a candle or lamp into the place. If this reaches the bottom unextinguished and burns with undiminished intensity, the vessel or well can be entered without apprehension. A diminished intensity of light indicates danger; total extinction proves that the atmosphere is fatal. To remove the gas strong ventilation may be adopted, but as this is not always practicable, the chemical method may be often used. A quantity of lime is slaked, and then is stirred with water so as to produce milk of lime. This is poured down the sides of the place, is thrown in fine spray down it, and is in any way distributed as thoroughly as possible, so as to act upon the gas. The process is continued until the lamp or candle test shows pure air. If all the lime were effective, one pound would combine with and remove about five cubic feet of carbonic acid gas. The capacity of the space to be freed of gas may be calculated and some basis reached as to the quantity of lime required. Owing to waste, several times the calculated quantity will be generally needed. It is essential that the lime should be freshly slaked.

The action of the lime upon the gas is one of combination. The carbonic acid gas enters into chemical combination with the lime, producing calcium carbonate or chalk. Thus the poison is effectually removed. Air acts by simply washing it out mechanically. The action of lime is altogether chemical.

The operation of air in displacing the gas is available in resuscitating men asphyxiated as spoken of above. In a recent number of this journal a pump for producing artificial respiration and injecting fresh air into the lungs was described. In gas poisoning or asphyxiation such an appliance may be the means of bringing about a speedy return to consciousness and life. The great object is to wash out the gas from the lungs, and this can be thoroughly effected by artificial respiration.

Too great care cannot be exercised in these cases. In many instances several men have been overcome

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