

IN THE FIELD OF ELECTRICITY

ELECTRICITY is not a form of energy any more than water is a form of energy. Water may be a vehicle of energy when at a high level or in motion; so may electricity. Electricity cannot be manufactured, as heat can; it can only be moved from place to place, like water; and its energy must be in the form of rotation or of strain, writes Sir Oliver Lodge, F. R. S., in Harper's Magazine. Electricity under strain constitutes "charge;" electricity in locomotion constitutes a current and magnetism; electricity in vibration constitutes light. What electricity itself is we do not know, but it may perhaps be a form or aspect of matter. So have taught for thirty years the disciples of Clerk-Maxwell.

Now we can go one step further and say matter is composed of electricity, and of nothing else—a thesis which I wish to explain and partially justify.

First we must ask what is positive electricity, and the answer is still we do not know. For myself I do not even guess—beyond supposing it to be a mode of manifestation, or a differentiated portion, of the continuous and all-pervading ether. It seems to exist in lumps the size of the atoms of matter; and no portion of it less in bulk than an atom has ever been isolated, nor appears likely to be isolated.

But concerning negative electricity we know a great deal more. This exists in excessively minute particles, sometimes called electrons and sometimes called corpuscles; these are thrown off the negatively charged terminal in a vacuum tube, and they fly with tremendous speed till they strike something. When they strike they can propel as well as heat the target, and they can likewise make it emit a phosphorescent glow, especially if it be made of glass or precious stones. If the target is a massive metal like platinum, the sudden stoppage of the flying electrons which encounter it causes the production of the ethereal pulses known as X-rays. Electrons are not very easy to stop, however; and a fair proportion of them can penetrate not only wood and paper, but sheets of such metals as aluminum and other moderately thin obstacles. That is because they are extremely small—much smaller than the atoms of matter.

Each electron has a definite charge of electricity—viz: the same charge as is conveyed by each single atom when a current is passed through a chemically conducting liquid. Every electron has also a definite and uniform mass, which is about 1/3600th of that of an atom of hydrogen—hitherto the lightest known form of matter.

From every kind of material the same and no other kind of electron can be obtained, and we have reason for asserting that no other kind exists.

Electric currents are always due to the locomotion of these little electric charges; they permeate and make their way through metals, being handed on from one atom to the next, as a fire bucket is passed from hand to hand. This is metallic conduction. Liquid conduction is different; the electrons travel with the atoms in liquids, and hence travel slowly, being jostled by the crowd, and being laden with the heavy atom which they convey or propel, as a pony (or a flea—in mass a pony, but in bulk a flea) might drag a heavy wagon through crowded streets, until at the terminal station it is unharnessed and allowed to trot into its stable, which is what happens when the boundary between liquid and metallic conductors is reached. Electrons become still more emancipated, however, in rarefied gases, which act as a cleared race course, or like a free range for flight; and then it is possible to find them flying at prodigious speed, even as high as 100,000 miles a second, and sometimes faster still, but never quite as fast as light.

Whenever an electron is suddenly started

or stopped, or made to turn a corner, it disturbs the ether through which it had been quietly moving and excites a ripple in it. These ethereal ripples constitute radiation, and the best known variety of them we call "light." With this we have been familiar for a long time, because of our happening to possess eyes—instruments for the ready appreciation of ethereal ripples. We used not to know the reason, however, for the production of light. We know now that it is due to the sudden change of motion, either in speed or direction, of an electron; and probably to no other cause.

The charge in an electron is very small, but is extremely concentrated—that is to say, it exists only as a very minute nucleus; and in order to explain the manifestation of the observed mass of 1/3600th part of a hydrogen atom by so trifling a quantity of electricity it is necessary to suppose that it is concentrated into a space one-hundred-thousandth of the diameter of a material atom. This is the size which is at present accepted for an electron. It is quite the smallest thing known.

Matter, then, appears to be composed of positive and negative electricity, and nothing else. All its newly discovered as well as all its long-known properties can thus be explained—even the long-standing puzzle of "cohesion" shows signs of giving way. The only outstanding still intractable physical property is "gravitation," and no satisfactory theory of the nature of gravitation has been so far forthcoming. I doubt, however, if it is far away. It would seem to be a slight but quite uniform secondary or residual effect due to the immersion of a negative electron in a positive atmosphere.

Harmless Third-Rail System.

An electric third-rail train system that is claimed to be safe and trustworthy has been invented by a Chicago man. By means of his device, in which the third rail is inverted, and practically hidden from view, the inventor declares it impossible for persons or animals to come in contact with the charged rail. Its efficacy, he maintains, is in no way affected by sleet, snow, rain, high winds, lightning or other weather conditions which heretofore have delayed traffic. In the new system the third or contact rail is stretched alongside the track by means of an iron support shaped much like the letter C, and is insulated at every point, except where the "shoe" travels, by a covering said to be practically indestructible. By a sectional system was meant one in which the electric power is conducted to the car or cars in sections of any desired length and made operative by the moving train. For example, if adopted on the elevated trains, they might be run with a headway of twenty seconds, and wherever it might be employed no section of the line would be charged unless occupied by a train. The same power that is used to propel the train is also employed to operate block signals and safety stops, as at crossings or intersections of the road. Other advantages claimed for the system over the overhead trolley and the open third rail are economy in the cost of installation, a saving in the cost of operation and maintenance, and also economy in power—the latter being assured by "positive insulation and non-exposure to the elements." Absolute safety, however, under any and all conditions, is the inventor's strongest claim for the system. As to the speed possible to attain by its use, practical tests are said to have shown that sixty miles an hour may be reached without any difficulty. "By the under-running trolley contact," said the inventor, "a pressure of but three pounds upon the third rail is sufficient for all operating requirements, while the top contact commonly employed necessitates a minimum weight of fourteen pounds on the elevated roads in Chicago and sixty pounds on the Boston elevated. This

weight makes the floating shoe tend to escape from the center of gravity as the resistance increases, whereas by our system any tendency to escape from the center of gravity adds to the shoe's contact capacity or pressure. Our shoe, or collector, is non-magnetic, instead of being made of cast iron, and is connected with the cars by protected wires. It is designed to wear to a very smooth surface, which eliminates the sliding or grinding noise usually heard."

New Single Phase Motor.

A communication in the London Electrician from L. Schuler, criticises a type of single-phase motor suggested recently by Rudolf Goldschmidt. In this the place of the commutator is taken by a collector with a small number of parts. An open coil winding is adopted, the repulsion principle being made use of. The idea was that the circuit of every coil would be broken when there was no current flowing; but Mr. Schuler contends that this condition of operation is not practical. He tried a motor of this type some time ago and found that it worked sparklessly if rotated slowly, but sparked badly when approaching full speed. The reason for this is that the coils on the rotor are cutting the magnetic lines, due to their motion, and there is no sparkless position for the brushes. A further objection to this type is that the use of a smaller number of rotor coils prevents the motor from developing its full starting torque in all positions of the rotor. A more uniform starting torque can only be obtained by increasing the number of rotor coils and commutator segments.

Pushing the Jungfrau Railway.

The famous Jungfrau railway is being rapidly pushed forward, and the great tunnel up through the heart of the mountain has now reached an altitude of over 10,000 feet. When 2,000 feet more have been pierced through the rock the Mer de Glace will be reached, where a fine station, observation gallery and buffet are to be cut out of the solid rock. The view from the Mer de Glace station will be the most magnificent in the whole of the Swiss Alps, for the Jungfrau Sea of Ice is the starting point of many of the most famous giant glaciers of Europe.

Wireless War Kites.

In the presence of the German kaiser some interesting experiments took place in the Baltic the other day with a newly discovered method of wireless telegraphy by means of kites, writes a Hamburg correspondent. The inventor is a German-American professor, at present residing at Havre, who has for a long time past been in communication with the German naval authorities, and has now displayed the new invention to the emperor personally. Naturally the strictest secrecy is observed regarding the whole matter, and every sailor to whom the new apparatus was shown was compelled to take an oath not to speak of the device. At the operations, which were carried out about a mile from shore, seven kites were flown on copper wires to a height of from 10,000 to 12,000 feet. The experiments were partly made from the kaiser's dispatch boat Helgner, travelling at the rate of thirty sea miles an hour, and several languages were employed. It is possible to employ the system over the greatest distances without affecting any other wireless telegraphy station. The form of the kites used is that of two cubes side by side. The patent will be acquired by the German navy.

Electrical Shoeblicks.

The Zimmerman automatic shiner, an electrically driven machine for polishing boots and shoes, is ousting the human shoeblick—perhaps. The apparatus consists chiefly of a rotated circular platform, which makes one complete revolution every two minutes. On the platform are placed

six seats. In one round the platform makes six stops of twenty second each. It is during these intervals, when the platform is at rest opposite the brush batteries fixed on the outer immovable rail, that the polishing is performed. The client steps onto the platform and seats himself on one of the six chairs. By using American hustle it is possible to be fairly settled by the time the platform has moved to station 1. There, during the first pause in the revolution, the first set of brushes descends on the now stationary shoes and removes all mud from the leather; station 2 applies a cleansing mixture; No. 3 rubs it off. At No. 4 the polish is put on, and at No. 5 the final polish is given. At the end of the sixth interval of twenty seconds the platform has brought the customer to the jumping-off station, with his shoes dazzling to the eyes of the beholder. Eighteen hundred pairs of shoes per day of ten hours each is the record of this new machine, and to accomplish this the attention of two boys is all that is necessary. They look after the clients and control the two-horse-power electric motor. The machine does the rest.

Lion Tamer's Escape

By turning on a sulphuric acid gas fire extinguisher in the face of a furious lion that had seized its tamer, John Forster, by the arm at the Sea Beach Palace zoo, Fireman Eli Sanderson saved Forster's life.

Forster was administering a calomel pill to the lion Romeo. Romeo was cross, and Forster pried the great iron jaws open with a powerful gag. Then he ran his arm down the roaring throat and placed the pill at the base of the tongue.

The gag gave way just at the crucial moment and Romeo's teeth closed with a snap in the flesh of Forster's arm. Warm blood spurted out into the lion's mouth, rendering him savage.

Forster, fainting with pain and terror, kept up cries for help until Private Fireman Sanderson, under the impression that a fire had broken out, came running with a fire extinguisher. He set up the extinguisher on the edge of the cage and turned the stream full on the lion's nose. The fumes of the nauseous gas filled his nostrils and blinded his eyes. He dropped the arm of the fainting keeper and slunk away into a corner of the cage, pawing at his nose and rolling his head on the floor. Sanderson entered the cage and carried out Forster, almost dead from loss of blood. One of the lion's incisors severed an artery, but except for a bad laceration of the arm the man was otherwise unhurt. A physician dressed the wounds and it is not thought that any serious results will follow.—New York Herald.

Apologetic Burglar

Tall and of slight build, a young man giving the name of Christopher Gergory, pleaded guilty at Clarksdown sessions to burglary. He left a note in the house which he entered. It ran:

"I took an oath that the first day I was without food I would get into the hands of the police, and this is the first time I have been in want of food and shelter. I dare not sleep in the open air, for my health is not of the best. I am sorry for the damage done to the shutters, also to the tree in the garden.

Assuring you of my regret for damaging your house, but it had to be, and you will be doing me a service if you prosecute. I am, sir, yours respectfully.

"C. GREGORY."

"Gregory" resolutely refused to state who he really is, but upon Mr. McConnell promising that nothing should be made public, he in court supplied some particulars privately.

He was then handed over to the missionary, who has found work for him.—London Mail.

