

EXPERIMENTAL PLANT OF THE PORTELECTRIC SYSTEM.

It is now something more than a year since the exhibition of the model of the portelectric system in the Old South Church in Boston. The subsequent description of this promising invention in the daily newspapers and technical journals attracted the notice of people in all parts of the world. It was at once recognized that, could the model be duplicated on a large scale, and be made to work with the same degree of success, its commercial utility and importance in the rapid transportation of mail and express packages would be very great.

Since the invention was first exhibited to the public, its projectors have been busily engaged in the construction of an experimental track upon which the "portelectric" car could be tested under conditions similar to those which would be met in actual practice, and fully as severe as those which would be encountered in commercial operation.

This experimental plant, which is located near the Howard street station on the New York and New England Railroad, in the suburbs of Boston, has been completed and in experimental operation for some time, but its construction and operation have been open to the inspection of the public only since the 11th of this month. Notwithstanding the difficulties, mostly of a mechanical nature, which necessarily had to be met and overcome in pioneer work of this kind, the experimental work has proved so successful that the performance of the system re-enforces the opinions formerly held by its projectors concerning its future commercial importance.

The system is intended for the transportation, not

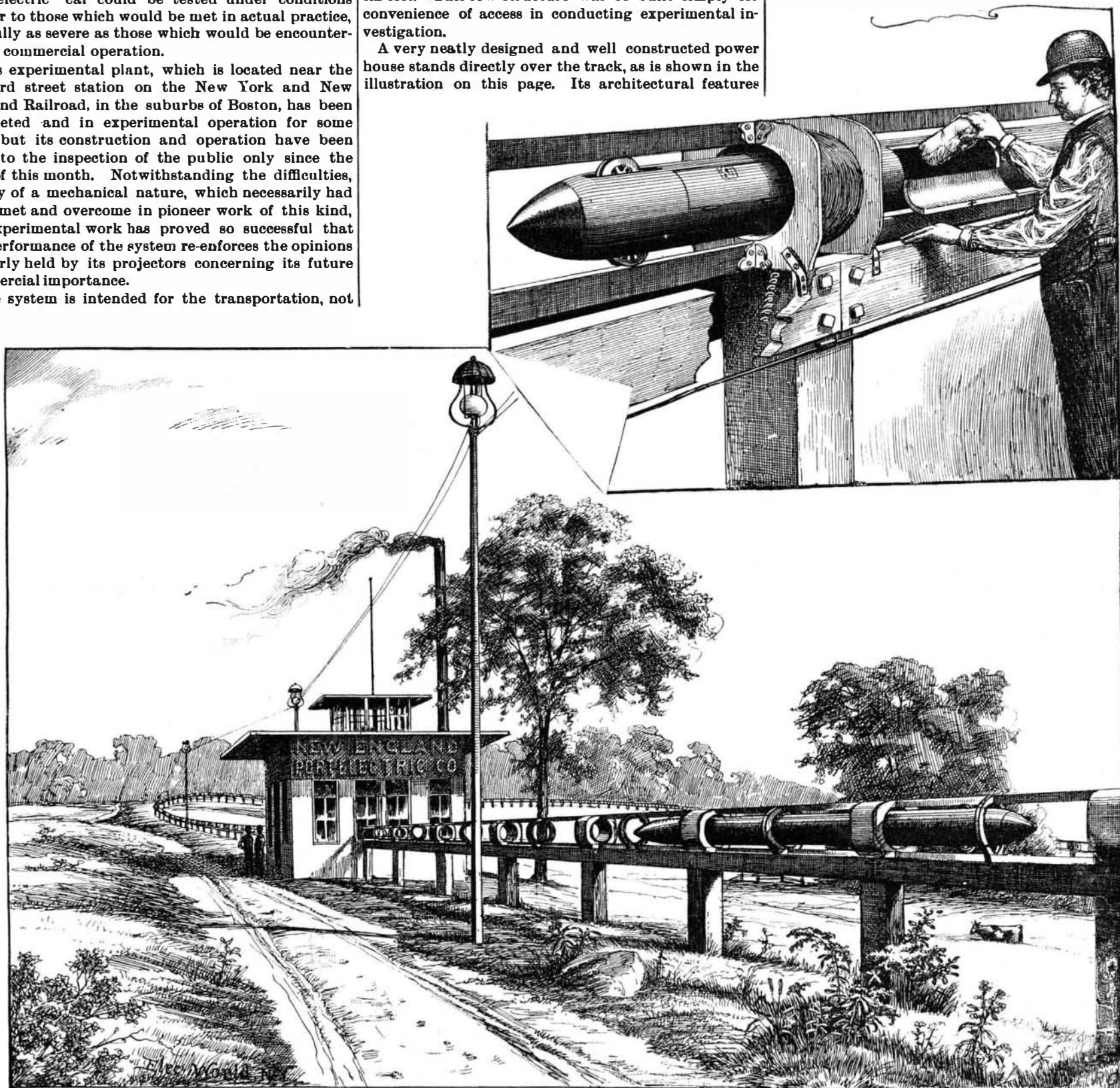
has been directed toward the reduction, as far as possible, of the copper wire required in the coils of the track solenoids.

The experimental line is nearly 3,000 feet long, built in the form of an oval or somewhat of a pear shape, including two curves of different radii, some straight and level sections, and grades, both on a straight track and on curves. One grade is 8 per cent and another 11 per cent. Posts 10 inches square are set solidly in the earth to a sufficient depth to be undisturbed by frost, and are packed about with sand. These posts project above the surface to a height of about four or five feet, and to their sides, at the top, are strongly bolted planks, three by ten inches, set on edge and carefully fitted, so that the top of the planks is flush with the top of the posts. Posts are set at intervals of six feet. This low structure was so built simply for convenience of access in conducting experimental investigation.

A very neatly designed and well constructed power house stands directly over the track, as is shown in the illustration on this page. Its architectural features

tend through these coils, one at the top and the other at the bottom. The lower track is in connection with one terminal of the dynamo, and the other terminal is connected with a lead wire parallel with the lower track. To this wire are attached branches connecting it to the various sections of the upper track, these sections being about six feet long. The passage of the car completes the circuit between the upper and lower rails through the solenoid in advance of the car, and the car is thus pulled into the coil until it is midway through the coil, when the current is cut out and transferred to the next coil in advance.

The car is an iron cylinder 10 inches in diameter, and, with its conical ends, is 12 feet long, and weighs 350 pounds. It runs on two wheels, and also has guide wheels to run on the track above the car. Doors upon



EXPERIMENTAL PLANT OF THE PORTELECTRIC SYSTEM OF TRANSPORTATION, BOSTON, MASS.

of passengers, but of mail and express matter only, at rates of speed approximating two miles per minute, the steel car being drawn along its confined path at this high rate by the pull of numerous solenoids through which the track is laid, each coil exerting its power for a short time only as the car approaches it.

In general principles the experimental track here described and illustrated does not differ from the model exhibited in the Old South Church last year. In the mechanical details, however, such changes have been made as have been found by actual experiments to be necessary to adapt the system to the requirements of commercial service.

The method of closing and opening the circuit through the track solenoids at the proper time has been changed. The mounting of the car upon its wheels, the construction of the track and some other mechanical details have been greatly improved. Prof. A. E. Dolbear, the electrician of the company, and Mr. John T. Williams have given the matter almost daily attention for several months, and especial care

are the design of Mr. J. Philipp Rinn, a Boston architect. The track passes directly through its center at a distance of about two feet from the floor. The building is surmounted by a lookout tower, from which the car may be watched as it speeds around its half mile course.

The power equipment of the station consists of a Sturtevant 20 h. p. engine and an Edco dynamo to furnish current for the propulsion of the car. This dynamo is wound for a pressure of 1,000 volts. A horizontal tubular boiler supplies steam for the engine and for the heating of the building as well. A small supply and work room is conveniently arranged in one corner of the building. The station is lighted by Bernstein series incandescent lamps, and the track is lighted when necessary with seven arc lights.

Upon the heavy framework of wood of which the track structure is composed are placed the solenoids, a series of coils extending along the entire track at intervals of six feet. These coils have an internal diameter of eleven inches, and are each made of about 20 pounds of No. 14 wire. The two rails of the track ex-

its side allow of the necessary matter constituting the load of the car to be placed upon its inside and securely locked in place.

The greatest difficulty experienced in the operation of this track and car was in the adaptation of the car to the compound curve, made up of a grade and a curve of short radius. It was found necessary to make the car itself rotate to accommodate itself to the curve and grade, thus introducing a great frictional resistance. In spite of this, however, the car has been drawn about the oval track in about one and a half minutes, and its speed has reached about 45 feet per second. The greatest acceleration observed was about $3\frac{1}{2}$ feet per second, which, if maintained for a minute, would give a speed of about two miles per minute. The shape and difficulties of the present track, however, prevent the acquiring of such a speed.

In forming an opinion of what has been already accomplished by the plant described above, it should be borne in mind that the whole project was so new that every step has had to be taken without the assistance of any precedent, or of the experience of others in simi-

lar work. Its growth, however, has been very satisfactory, and Professor Dolbear asserts that there is every reason for thinking that in a short time the car will be capable of running away from the swiftest express train.—*Electrical World*.

PHOTOGRAPHIC NOTES.

How to Utilize Light-struck Plates.—It often happens that through carelessness or accident sensitive dry plates become light-struck. Instead of being thrown away as useless, the plates may be doctored so that they can be used in the camera, though their rapidity may be somewhat decreased.

The *Br. Jour. of Photo.* advises that the damaged plates be immersed for five minutes in the following solution:

Bichromate of potash.....	1 ounce.
Hydrobromic acid (sp. gr. 1.400).....	2 fluid drachms.
Water.....	10 ounces.

If hydrobromic acid is not obtainable, hydrochloric acid or a soluble bromide may be used, to which a few drops of sulphuric acid should be added. After immersion the plates should be carefully washed and reared up to dry. Their sensitiveness will be increased by immersing in a plain alkaline solution for two or three minutes.

Subterranean Photography.—A Mr. Langlois has constructed an apparatus for photographing underground where the only means of access to the locality is a narrow shaft. The camera is very small, holds a 2 inch square sensitive plate, and has a lens of very short focus.

The whole is placed in metal case or tube, open on one side, and can be lowered by means of a cord or small chain attached to the tube. The camera is pivoted within the tube, at its upper end, so that it can be kept at an angle by means of another cord or small chain fastened to its lower end. Above and below the camera are arranged rows of small incandescent electric lamps.

When the apparatus is lowered, and the camera made to incline outward from the case, the current is turned on and the plate exposed. The photographs thus obtained are said to be excellent.—*Mechanical World and Photo. News*.

Method of Holding Separate Celluloid Films in the Dark Slide.—Says Ethel C. May on this subject, in a communication to the *Br. Jour. of Photo.*: "We are generally instructed to lay the films in the holder like a glass plate, and to back them with a piece of cardboard. But the film and backing often slip back and get out of register.

"The plan I have adopted is to take some dark chocolate-colored mounts, and with heavy scissors trim them down 1/64 of an inch smaller than the rabbit of the dark slide. Take some strips of gummed paper, the same as that on the margin of postage stamp sheets, and fasten one over each corner of the card, gluing it firmly to the back by the glue which the strip possesses, taking care not to moisten the corner itself. When dry, slip the celluloid films under these corners, and they will be found to lie beautifully flat, and can be laid in the slide just like a plate. Over them I lay a piece of pretty stout mill board or Eastman's film carrier board, and close the slide, being careful that the pressure of the spring of the partition is only just sufficient to keep the films up to the rabbit. Instead of the spring board a tuft of cotton can be used, large enough to act as a spring in keeping the films pressed outward."

The extreme thinness of the paper at the corners prevents any possibility of the film being out of register, a point which is likely to occur if metal corners are used. The foregoing description applies to the book slide, which opens like a book. For plates which slide in the holder it may answer equally as well.

Process of Toning Dry Plate Lantern Slides.—Mr. W. P. Christian, of the Liverpool Amateur Photographic Association, as reported in the *Br. Jour. of Photo.*, suggests the following modification of Mr. G. F. Blackmore's formula:

After the slide has been developed, wash under the tap, and before fixing bleach it in a bichloride mercury bath—

Bichloride mercury.....	1 ounce.
Water.....	20 ounces.

Then wash well and immerse in the following bath:

No. 1.	
Water.....	14 ounces.
Hyposulphite of soda bath (1 ounce to 6 ounces of water).....	3 minims.
Sulphocyanide of ammonia.....	40 grains.

No. 2.	
Chloride of gold.....	5 grains.
Water.....	2½ ounces.

The bath is made by adding half an ounce of No. 2 to two ounces of No. 1, and should be kept mixed a few days, as it works better. The tones produced vary from yellowish brown to golden brown and deeper brown, passing afterward to purple and steady blue black.

The time of toning may be accelerated by adding more of the gold solution. More hypo gave a yellowish brown tint or more sulphocyanide a blackish

brown. He preferred a bath rich in gold, which gives a peculiarly warm, luminous character to the slide. Other range of tones could be effected by dipping the plate in the gold solution (one grain to one ounce) alone just after bleaching, before putting it into the toning solution. If chloride plates are used, the bleaching is not necessary. Any yellowish stain in the slide after toning is removed by immersing in a weak bath of hydrochloric acid and water.

The principle of this toning process is to first convert the reduced bromide image into a chloride, by means of bichloride of mercury, then to tone and fix it at one operation in the sulphocyanide and hypo gold bath. Care should be taken not to develop the slide too far, otherwise it may be too dense.

An *Eikonogen Developer*, said to be very simple, and to work good for lantern slide plates, is advised by T. A. Sinclair, of the same association:

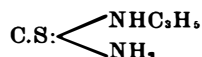
No. 1.	
Eikonogen.....	½ ounce.
Sulphite soda.....	2 ounces.
Water.....	20 ounces.

No. 2.	
Washing soda.....	2 ounces.
Carbonate of potash.....	2 ounces.
Water.....	20 ounces.

Take one ounce of No. 1, half an ounce of No. 2, and add half an ounce of water. This will develop eight or ten plates in succession.

New Use of Eikonogen in Reversing the Photographic Image.—That eikonogen is adapted to produce a positive image as well as a negative, on plates exposed directly in the camera, is one of the latest discoveries of its probable many uses. It was discovered accidentally.

We refer to the recent published reports of the experiments of Colonel Waterhouse, of Calcutta, India, who, in trying to find some good preservative for the eikonogen solution, accidentally noticed that a certain chemical added to the solution developed a plate into a positive instead of a negative. The chemical is called thio-sinamine, or allyl-thio-carbamide, the formula of which is—



He says of it: It is prepared by treating allyl-thio-carbamide, or the essential oil of black mustard, with ammonia; is more soluble in cold water than the phenyl-thio-carbamide, and is also soluble in alcohol. A nearly saturated solution can be made by adding four parts of the strongest liquor ammonia to one part of the ordinary essential oil of mustard obtained from the druggist. As soon as the ammonia has taken up as much of the oil as it will, the solution may be decanted off and the ammonia allowed to evaporate.

Of the solution thus prepared, about one part in 100 of the mixed eikonogen developer, as above, is sufficient to produce reversal on development. A little bromide may be added, and a slight trace of ammonia seems beneficial. It is advisable to evaporate the solution as prepared above, and obtain the thio-sinamine in a crystalline and odorless form, in which it may be purchased in Europe. Of the saturated solution of the crystals, from one-half to one part in 100 parts of the developer is enough.

Col. Waterhouse tries to explain the theory on which the reversal is based, and thinks the sulphur in the compound is the active agent. Over-exposure of the plate prevents reversal. He continues: "The results obtained seem to warrant the hope that it may be possible to perfect the process for practical use, but a great deal of work has yet to be done before the conditions of successful working can be fully ascertained. As in all these processes of reversal, the balance between reversal and non-reversal is a very delicate one. In any case an entirely new method of producing reversed negatives, with so many novel features, must be of interest, and, it is to be hoped, may throw some light upon the still unsolved problems connected with the formation and reversal of the developed photographic image."

"For copying line subjects, it is an improvement to use the eikonogen and phenyl-thio-carbamide developer, and before developing to give the plates a preliminary bath of dilute nitric acid at five per cent, or of bichromate of potash solution at about three or four per cent, the solutions being flowed over the plate in a tray, and washed off quickly. By this means greater density is obtained in the lines, together with clearer whites. The reversal takes place slowly, but is more complete, and the change is quite visible, the lines turning black on a light ground. Greater clearness of the ground may also be obtained by treating the plate before fixing with a solution of bromide of copper at two or three per cent. But care must be taken not to weaken the lines too much."

"In working with thio-sinamine, good reversals have been obtained of half-tone subjects by adding about ten drops of a ten per cent bichromate of potash solution to the ounce of eikonogen developer."

"For copying work the process seems quite practical, as proved by heliogravure plates produced directly from the reversed negatives taken in the camera, by

which one operation (either the taking of a negative or of an intermediate positive) is saved." We extract the foregoing from the *Br. Jour. of Photo.*

We have been unable to find the thio-sinamine in stock at some of the largest dealers in rare chemicals in this country, but were informed that it could be obtained from Germany at a cost of one dollar per half-ounce. We have not yet tried it, but believe Col. Waterhouse's deductions to be reliable.

When the process is fully worked out, it may be possible to make successive exposures of one landscape on a roll of bromide paper which may be developed out as positives, and thus avoid the interposed negative. It seems remarkable that such an important discovery should be made within a year of the introduction of the eikonogen developer.

Alternating versus Continuous Currents in Relation to the Human Body.

BY H. NEWMAN LAWRENCE, M.I.E.E., AND ARTHUR HARRIES, M.D.

This was a paper lately read before the British Association. The authors say their experiments were made:

1. By using currents directly from lighting circuits, both alternating and continuous.
2. By using currents directly from a dynamo whose rate of alternation could be accurately ascertained.
3. By using currents of high E. M. F.
4. By using an instrument for the measurement of alternating currents whose accuracy has been tested and proved to give correct readings by an eminent practical electrician.

Another practical point to which special attention has been given in this paper is that the experiments have been made chiefly with the skin in a state of nature, so that the conditions of experiment as nearly as possible resemble those which might be expected to exist under accidental circumstances—that is to say, under circumstances when contact with conductors was unexpected, and, therefore, unprovided for.

We omit the details of the various experiments. At the end of the paper the authors say:

We will now briefly summarize our conclusions, and in doing so desire to draw attention to the fact that they are based upon certain conditions, and while we believe them to be sufficiently accurate and reliable under these conditions, we in no sense claim them as true under all conditions.

Conclusions.

A. When the human body, with its skin in its normal unmoistened condition, comes into contact for an appreciable time with bare metal conductors of a dynamo-generated continuous current passing at about 100 volts, in such a way that the current passes from hand to hand, and the total contact area is about 90 square centimeters:

- (1) A current of about 0.016 ampere will pass through it.
- (2) This current can be borne without discomfort for 15 to 30 seconds.
- (3) After about 30 seconds unpleasant burning sensations become marked and quickly increase.
- (4) The subject is perfectly able to release himself at will during any portion of the time of contact.

B. When the human body comes into contact with dynamo-generated alternating currents, alternating at about 60 to 70 per second, under the same conditions as above:

- (1) A current of about 0.025 ampere will pass through it.
- (2) The current is six times greater than that which produces discomfort.
- (3) Instantly the subject is fixed by violent muscular contraction and suffers great pain.
- (4) The subject is utterly unable to release himself, but remains exposed to the full rigor of all the current that may be passing.

C. When circuit from electric light or power conductors is accidentally completed through the human body, the danger of serious consequences is many times greater when alternating than when continuous currents are passing at equal voltage, and this is still to a large extent true if the voltage of the continuous current be double that of the alternating.

D. (1) With both forms of current a reduction of contact area materially reduces the amount of current strength that passes.

(2) With the alternating current, if the rate of alternation be reduced below 50 per cent, the sensations of pain accompanying muscular fixation will be increased, while if the rate of alternation be increased, the pain will be diminished.

Finally, we would remind those gentlemen who so commonly speak as if voltage were the chief or only factor in the danger of accidental contact, that *current strength is the important item*, and that according to Ohm's law current strength is dependent not only upon E.M.F., but upon the total resistance in circuit at the time of accidental contact. To make statements based upon voltage only, such as newspaper reports of a recent execution have contained, is not only distinctly misleading, but calculated to induce the uninitiated to form erroneous conclusions.