Technical and Bibliographic Notes / Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- [x] Coloured covers/ Couverture de couleur
- [ ] Covers damaged/ Couverture endommagée
- [ ] Covers restored and/or laminated/ Couverture restaurée et/ou pelliculée
- [ ] Cover title missing/ Le titre de couverture manque
- [ ] Coloured maps/ Cartes géographiques en couleur
- [x] Coloured ink (i.e. other than blue or black)/ Encre de couleur (i.e. autre que bleue ou noire)
- [ ] Coloured plates and/or illustrations/ Planches et/ou illustrations en couleur
- [x] Bound with other material/ Relié avec d'autres documents
- [x] Tight binding may cause shadows or distortion along interior margin/ La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure
- [ ] Blank leaves added during restoration may appear within the text. Whenever possible, these have been omitted from filming/ Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.

- [ ] Coloured pages/ Pages de couleur
- [ ] Pages damaged/ Pages endommagées
- [ ] Pages restored and/or laminated/ Pages restaurées et/ou pelliculées
- [x] Pages discoloured, stained or foxed/ Pages décolorées, tachetées ou piquées
- [ ] Pages detached/ Pages détachées
- [x] Showthrough/ Transparence
- [x] Quality of print varies/ Qualité inégale de l'impression
- [x] Continuous pagination/ Pagination continue
- [ ] Includes index(es)/ Comprend un (des) index

Title on header taken from:/ Le titre de l'en-tête provient:

- [ ] Title page of issue/ Page de titre de la livraison
- [ ] Caption of issue/ Titre de départ de la livraison
- [ ] Masthead/ Générique (périodiques) de la livraison

- [x] Additional comments:/ Commentaires supplémentaires: Various pagings.

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous.

10X	12X	14X	16X	18X	20X	22X	24X	26X	28X	30X	32X
									✓		

CANADIAN ELECTRICAL NEWS AND STEAM ENGINEERING JOURNAL

OLD SERIES, VOL. XV.—No. 4.
NEW SERIES, VOL. III.—No. 9.

SEPTEMBER, 1893

PRICE 10 CENTS
$1.00 PER YEAR.

CANADIAN

ELECTRICAL NEWS

AND

STEAM ENGINEERING JOURNAL.

VOL. III. SEPTEMBER, 1893 No. 9.

ON LIGHT AND OTHER HIGH FREQUENCY PHENOMENA.*

BY NIKOLA TESLA.

INTRODUCTORY.

WHEN we look at the world around us, on Nature, we are impressed with its beauty and grandeur. Each thing we perceive, though it may be vanishingly small, is in itself a world, that is, like the world of the visible universe, matter and force governed by law—a world, the contemplation of which fills us with feelings of wonder and irresistibly urges us to ceaseless thought and inquiry. But in all this vast world, of all objects our senses reveal to us, the most marvellous, the most appalling to our imagination, appears nodoubt a highly developed organism, a thinking being. If there is anything fitted to make us admire Nature's handiwork, it is certainly this inconceivable structure, which performs its innumbeable motions in obedience to external influence. To understand its workings, to get a deeper insight into this Nature's master-piece, has ever been for thinkers a fascinating aim, and after many centuries of arduous research men have arrived at a fair understanding of the functions of its organs and senses. Again, in all perfect harmony of its parts, of parts which constitute the material or tangible of our being, of all its organs and senses, the eye is the most wonderful. It is the most precious, the most indispensable of our respective or directive organs, it is the great gateway through which all knowledges enters the mind. Of all our organs it is the one which is in the most intimate relation with that which we call intellect. So intimate is this relation, that it is often said that the very soul shows itself in the eye.

It can be taken as a fact which the theory of the action of the eye implies, that for each external impression, that is, for each image produced upon the retina, the ends of the visual nerves, concerned in the conveyance of the impression to the mind, must be under a peculiar stress or in a vibratory state. It now does not seem improbable that, when by the power of thought an image is evoked, a distinct reflex action, no matter how weak, is exerted upon certain ends of the visual nerves, and therefore upon the retina. *Will it ever be within human power to analyze* the condition of the retina when disturbed by thought or reflex action, by the help of some optical or other means of such sensitiveness that a clear idea of its state might be gained at any time? If this were possible, then the problem of reading one's thoughts with precision, like the characters of an open book, might be much easier to solve than many problems belonging to the domain of positive physical science in the solution of which many, if not the majority, of scientific men implicitly believe. Helmholtz has shown that the fundi of the eyes are themselves luminous, and he was able to see, in total darkness, the movement of his arm by the light of his own eyes. This is one of the most remarkable experiments recorded in the history of science, and probably only a few men could satisfactorily repeat it, for it is very likely that the luminosity of the eyes is associated with uncommon activity of the brain and great imaginative power. It is fluorescence of brain action, as it were.

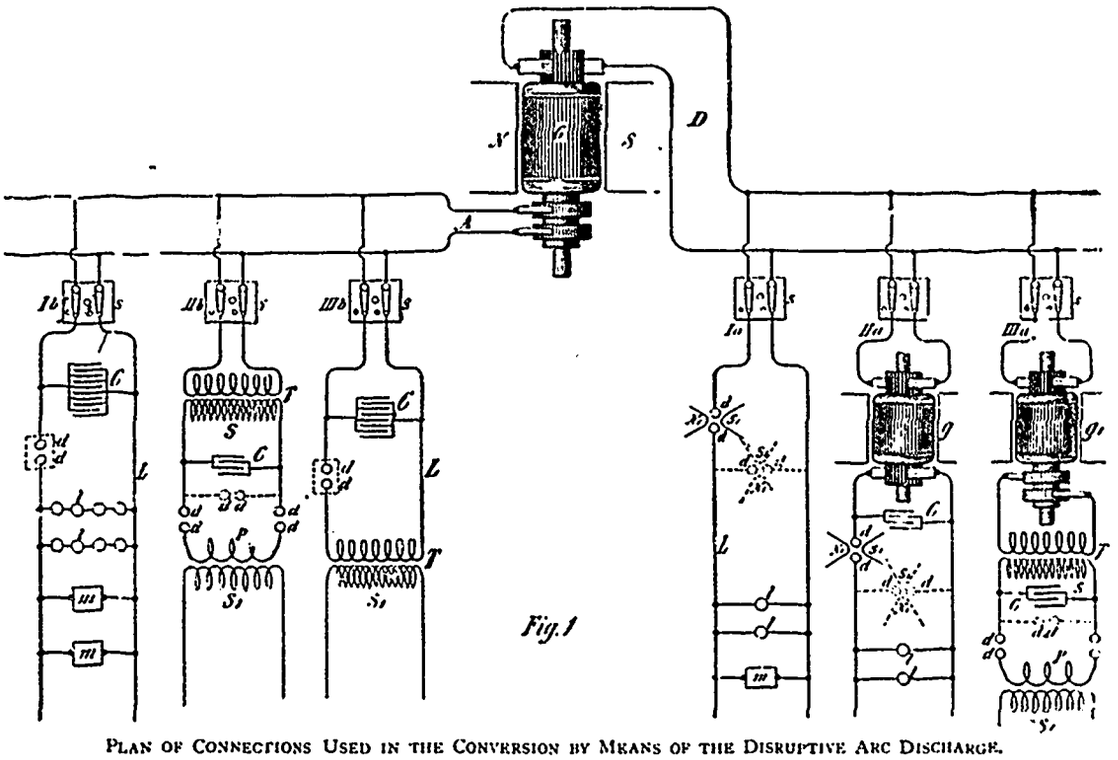

Fig. 1

PLAN OF CONNECTIONS USED IN THE CONVERSION BY MEANS OF THE DISRUPTIVE ARC DISCHARGE.

Another fact having a bearing on this subject which has probably been noted by many, since it is stated in popular expressions, but which I cannot recollect to have found chronicled as a positive result of observation, is that at times, when a sudden idea or image presents itself to the intellect, there is a distinct and sometimes painful sensation of luminosity produced in the eye, observable even in broad daylight.

The saying then that the soul shows itself in the eye is deeply founded, and we feel that it expresses a great truth. It has a profound meaning even for one who, like a poet or artist, only following his inborn instinct or love for Nature, finds delight in aimless thoughts and in the mere contemplation of natural phenomena, but a still more profound meaning for one who, in the spirit of positive scientific investigation, seeks to ascertain the causes of the effects. It is principally the natural philosopher, the physicist, for whom the eye is the subject of the most intense admiration.

Two facts about the eye must forcibly impress the mind of the physicist, notwithstanding he may think or say that it is an imperfect optical instrument, forgetting that the very conception of *that which is perfect, or seems so to him, has* been gained through this same instrument. First, the eye is, as far as our positive knowledge goes, the only organ which is directly affected by that subtle medium which, as science teaches us, must fill

*A lecture delivered before the Franklin Institute, at Philadelphia, Feb. 24th, 1891, and before the National Electric Light Association, at St. Louis, Mo., March 1, 1893.

all space; secondly, it is the most sensitive of our organs, incomparably more sensitive to external impressions than any other.

The organ of hearing implies the impact of ponderable bodies, the organ of smell the transference of detached material particles, and the organs of taste and of touch or force, the direct contact, or at least some interference of ponderable matter, and this is true even in those instances of animal organisms, in which some of these organs are developed to a degree of truly marvelous perfection. Thus being so, it seems wonderful that the organ of sight solely should be capable of being stirred by that which all our other organs are powerless to detect, which yet plays an

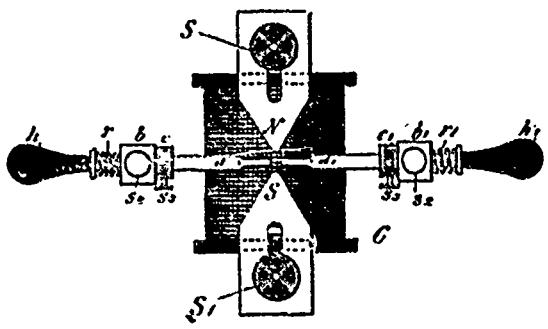

Fig. 2

FORM OF DISCHARGER WITH MAGNET USED IN THE DIRECT CURRENT CONVERSION.

essential part in all natural phenomena, which transmits all energy and sustains all motion, and, that most intricate of all, life, but which has properties such that even a scientifically trained mind cannot help drawing a distinction between it and all that is called matter. Considering merely this, and the fact that the eye, by its marvelous power, widens our otherwise very narrow range of perception far beyond the limits of this small world which is our own, to embrace myriads of other worlds, suns and stars in the infinite depths of the universe, would make it justifiable to assert that it is an organ of a higher order. Its performances are beyond comprehension. Nature, as far as we know, never produced anything more wonderful. We can get barely a faint idea of its prodigious power by analyzing what it does and by comparing. When ether waves impinge upon the human body, they produce the sensations of warmth or cold, pleasure or pain, or perhaps other sensations of which we are not aware, and any degree or intensity of these sensations, which degrees are infinite in number, hence an infinite number of distinct sensations. But our sense of touch, or our sense of force, cannot reveal to us these differences in degree or intensity, unless they are very great. Now we can readily conceive how an organism, such as the human in the eternal process of evolution, or, more philosopically speaking, adaptation to Nature, being

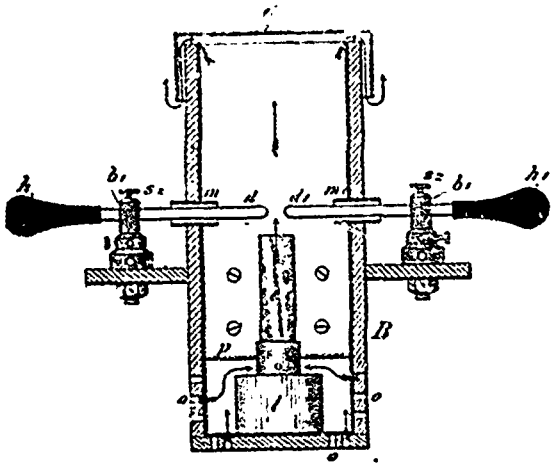

Fig. 3

DISCHARGES WITH HOT AIR DRAUGHT.

constrained to the use of only the sense of touch or force, for instance, might develop this sense to such a degree of sensitiveness or perfection that it would be capable of distinguishing the minutest differences in the temperature of a body even at some distance, to a hundredth, or thousandth, or millionth part of a degree. Yet, even this apparently impossible performance would not begin to compare with that of the eye, which is capable of distinguishing and conveying to the mind in a single instant innumerable peculiarities of the body, be it in form or color or other respects. This power of the eye rests upon two things, namely, the rectilinear propagation of the disturbance by which it is affected, and upon its sensitiveness. To say that the eye is sensitive is not saying anything. Compared with it, all other organs are monstrously crude. The organ of smell which guides a dog on the trail of a deer, the organ of touch or force which guides an insect in its wanderings, the organ of hearing, which is affected by the slightest disturbances of the air, are sensitive organs, to be sure, but what are they compared with the human eye! No doubt it responds to the faintest echoes or reverberations of the medium; no doubt, it brings us tidings from other worlds, infinitely remote, but in a language we cannot as yet always understand. And why not? Because we live in a medium filled with air and other gases, vapors and a dense mass of solid particles flying about. These play an important part in many phenomena, they fritter away the energy of the vibrations before they can reach the eye, they too, are the carriers of germs of destruction, they get into our lungs and other organs, clog up the channels and imperceptibly, yet inevitably, arrest the stream of life. Could we but do away with all ponderable matter in the line of sight of the telescope, it would reveal to us undreamt of marvels. Even the unaided eye, I think, would be capable of distinguishing in the pure medium small objects at distances measured probably by hundreds or perhaps thousands of miles.

But there is something else about the eye which impresses us still more than these wonderful features which we observe, viewing it from the standpoint of a physicist, merely as an optical instrument—something which appeals to us more than its *marvelous faculty of being directly affected by the vibrations of* the medium, without interference of gross matter, and more than

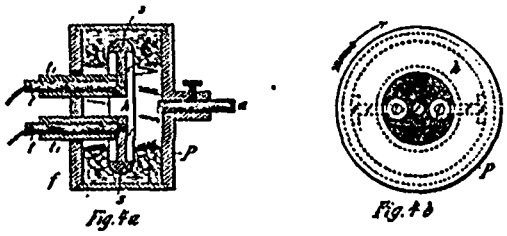

Fig. 4a *Fig. 4b*

FORM OF DISCHARGER WITH LIQUID INTERRUPTER.

its inconceivable sensitiveness and discerning power. It is its significance in the processes of life. No matter what one's views on Nature and life may be, he must stand amazed when, for the first time in his thoughts, he realizes the importance of the eye in the physical process and mental performances of the human organism. And how could it be otherwise, when he realizes that the eye is the means through which the human race has acquired the entire knowledge it possesses, that it controls all our motions, more still, all our actions.

There is no way of acquiring knowledge except through the eye. What is the foundation of all philosophical systems of ancient and modern times, in fact of all the philosophy of man? I am, I think; I think, therefore I am. But how could I think and how would I know that I exist, if I had not the eye? For knowledge involves consciousness; consciousness involves ideas, conceptions; conceptions involve pictures or images, and images the sense of vision, and therefore the organ of sight. But how about blind men, will be asked? Yes, a blind man may depict in magnificent poems *forms and scenes from real life*, from a world he physically does not see. A blind man may touch the keys of an instrument with unerring precision, may build the fastest boat, may discover and invent, calculate and construct, may do still greater wonders—but all the blind men who have done such things have descended from those who had seeing eyes. Nature may reach the same result in many ways. Like a wave in the physical world, in the infinite ocean of the *medium which pervades all, so in the world of organisms, in life*, an impulse started proceeds onward, at times, maybe with the speed of light, at times, again, so slowly that for ages and ages

Fig. 5

ILLUSTRATING THE EFFECT OF VARYING ELECTROSTATIC FORCE WITH A TRANSFORMER OF 200,000 VOLTS PRESSURE.

it seems to stay, passing through processes of a complexity inconceivable to men, but in all its forms, in all its stages, its energy ever and ever integrally present. A single ray of light from a distant star falling upon the eye of a tyrant in bygone times may have altered the course of his life, may have changed the destiny of nations, may have transformed the surface of the globe, so intricate, so inconceivably complex are the processes in Nature. In no way can we get such an overwhelming idea of the grandeur of Nature than when we consider that in accordance with the law of the conservation of energy, throughout the infinite, the forces are in a perfect balance, and hence the energy of a single thought may determine the motion of a universe. It is not necessary that every individual, not even that every generation or many generations, should have the physical instrument of sight, in order to be able to form images and to think, that is, form ideas or conceptions; but sometime

or other, during the process of evolution, the eye certainly must have existed, else thought, as we understand it, would be impossible, else conceptions, like spirit, intellect, mind, call it as you may, could not exist. It is conceivable that in some other world, in some other beings, the eye is replaced by a different organ, equally or more perfect, but these beings cannot be men.

Now what prompts us to all voluntary motions and actions of any kind? Again the eye. If I am conscious of the motion, I must have an idea of conception, that is, an image, therefore the eye. If I am not precisely conscious of the motion, it is because

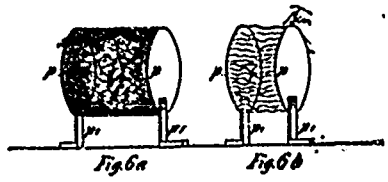

Fig. 6a Fig. 6b

ILLUSTRATING THE EFFECTS OF RAPIDLY VARYING AND STEADY ELECTROSTATIC FORCE.

the images are vague or indistinct, being blurred by the superimposition of many. But when I perform the motion, does the impulse which prompts me to the action come from within or from without? The greatest physicists have not disdained to endeavor to answer this and similar questions, and have at times abandoned themselves to the delights of pure and unrestrained thought. Such questions are generally considered not to belong to the realm of positive physical science, but will before long be annexed to its domain. Helmholtz has probably thought more on life than any other modern scientist. Lord Kelvin expressed his belief that life's process is electrical, and that there is a force inherent to the organism and determining its motions. Just as much as I am convinced of any physical truth I am convinced that the motive impulse must come from the outside. For, consider the lowest organism we know—and there are probably many lower ones—an aggregation of a few cells only. If it is capable of voluntary motion, it can perform an infinite number of motions, all definite and precise. But now a mechanism consisting of a finite number of parts, and a few at that, cannot perform an infinite number of definite motions, hence the impulses which govern its movements must come from the environment. So the atom, the ulterior element of the universe's structure, is tossed about in space eternally, a play to external influences, like a float in a troubled sea. Were it to stop its motion it would die. Matter at rest, if such a thing could exist, would be matter dead. Death of matter! Never has a sentence of deeper philosophical meaning been uttered. This is the way in which Prof. Dewar forcibly expresses it in the description of his admirable experiments, in which liquid oxygen is handled as one handles water, and air at ordinary pressure is made to condense and even to solidify by the intense cold. Experiments, which serve to illustrate, in his language, the last feeble manifestations of life, the last quiverings of matter about to die. But human eyes shall not witness such death. There is no death of matter, for throughout the infinite universe all has to move, to vibrate; that is to live.

I have made the preceding statements at the peril of treading upon metaphysical ground in my desire to introduce the subject of this lecture in a manner not altogether uninteresting, I may hope, to an audience such as I have the honor to address. But, now then, returning to the subject, this divine organ of sight, this indispensable instrument for thought and all intellectual enjoyment, which lays open to us the marvels of this universe, through which we have acquired what knowledge we possess, and which prompts us to, and controls, all our physical and mental activity. By what is it affected? By light! What is light?

We have witnessed the great strides which have been made in all departments of science in recent years. So great have been the advances that we cannot refrain from asking ourselves, Is this all true, or is it but a dream? Centuries ago men have lived, have thought, discovered, invented, and have believed that they were soaring, while they were merely proceeding at a snail's pace. So we, too, may be mistaken. But taking the truth of the observed events as one of the implied facts of science, we must rejoice in the immense progress already made, and still more in the anticipation of what must come, judging from the possibilities opened up by modern research. There is, however, an advance which we have been witnessing, which must be particularly gratifying to all lovers of progress. It is not a discovery, or an invention, or an achievement in any particular direction. It is an advance in all directions of scientific thought and experiment. I mean the generalization of the natural forces and phenomena, the looming up of a certain broad idea on the scientific horizon. It is this idea which has, however, long ago taken possession of the most advanced minds, to which I desire to call your attention, and which I intend to illustrate, in a general way, in these experiments, as the first step in answering the question, "What is light?" and to realize the modern meaning of this word.

It is beyond the scope of my lecture to dwell upon the subject of light in general, my object being merely to bring presently to your notice a certain class of light effects and a number of phenomena observed in pursuing the study of these effects. But to be consistent in my remarks it is necessary to state that according to that idea, now accepted by the majority of scientific men as a positive result of theoretical and experimental investigation, the various forms or manifestations of energy which were generally designated as "electric," or more precisely "electromagnetic," are energy manifestations of the same nature as those of radiant heat and light. Therefore, the phenomena of light and heat, and others besides these, may be called electrical phenomena. Thus electrical science has become the mother science of all, and its study has become all important. The day when we shall know what "electricity" is will chronicle an event probably greater, more important than any other recorded in the history of the human race. The time will come when the comfort, the very existence perhaps of man will depend upon that wonderful agent. For our existence and comfort we require heat, light and mechanical power. How do we get these? We get them from fuel, we get them by consuming material. What will man do when the forests disappear? when the coal fields are exhausted? Only one thing, according to our present knowledge will remain; that is, to transmit power at great distances. Men will go to the waterfalls, to the tides, which are the stores of an infinitesimal part of Nature's immeasurable energy. There will they harness the energy and transmit the same to their settlements, to warm their homes by, to give them light, and to keep their obedient slaves, the machines, toiling. But how will they transmit this energy if not by electricity? Judge then, if the comfort, nay, the very existence, of man will not depend on electricity. I am aware that this view is not that of a practical engineer, but neither is it that of an illusionist, for it is certain that power transmission, which at present is merely a stimulous to enterprise, will some day be a dire necessity.

It is more important for the student who takes up the study of light phenomena to make himself thoroughly acquainted with certain modern views, than to peruse entire books on the subject of light itself, as disconnected from these views. Were I, therefore, to make these demonstrations before students seeking information—and for the sake of the few of those who may be present, give me leave to so assume—it would be my principal endeavor to impress these views upon their minds in this series of experiments.

It might be sufficient for this purpose to perform a simple and well known experiment. I might take a familiar appliance, a Leyden jar, charge it from a frictional machine, and then discharge it. In explaining to you its permanent state when charged, and its transitory condition when discharging, calling your attention to the forces which enter into play and to the

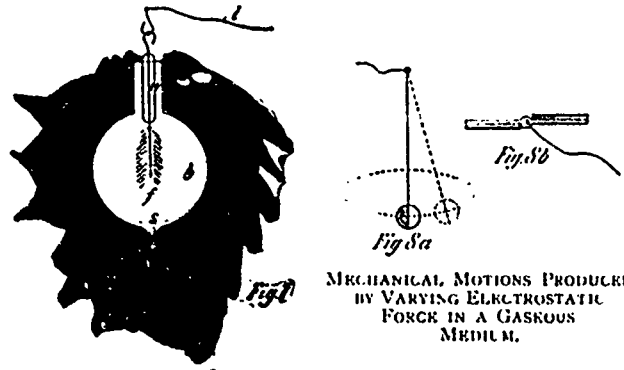

Fig. 8a Fig. 8b

MECHANICAL MOTIONS PRODUCED BY VARYING ELECTROSTATIC FORCE IN A GASEOUS MEDIUM.

BREAKING A BULB ON OPEN CIRCUIT.

various phenomena they produce, and pointing out the relation of the forces and phenomena, I might fully succeed in illustrating that modern idea. No doubt, to the thinker, this simple experiment would appeal as much as the most magnificent display. But this is to be an experimental demonstration, and one which should possess, besides instructive, also entertaining features, and, as such, a simple experiment, such as the one cited, would not go very far toward the attainment of the lecturer's aim. I must, therefore, choose another way of illustrating, more spectacular, certainly, but perhaps also more instructive. Instead of the frictional machine and Leyden jar I shall avail myself in these experiments of an induction coil of peculiar properties, which was described in detail by me in a lecture before the London Institution of Electric Engineers, in February, 1892. This induction coil is capable of yielding currents of enormous potential differences, alternating with extreme rapidity. With this apparatus I shall endeavor to show you three distinct classes of effects, or phenomena, and it is my desire that each experiment, while serving for the purposes of illustration, should, at the same time, teach us some novel truth, or show us some novel aspect of this fascinating science. But before doing this it seems proper and useful to dwell upon the apparatus employed, and method of obtaining the high potentials and high frequency currents which are made use of in these experiments.

ON THE APPARATUS AND METHOD OF CONVERSION.

These high frequency currents are obtained in a peculiar manner. The method employed was advanced by me about two years ago in an experimental lecture before the American Institute of Electrical Engineers. A number of ways, as practiced in the laboratory, of obtaining these currents, either from

continuous or low frequency alternating currents, is diagrammatically indicated in Fig. 1, which will be later described in detail. The general plan is to charge condensers, from a direct or alternate current source, preferable of high tension, and to discharge them disruptively while observing well known conditions necessary to maintain the oscillations of the current. In view of the general interest taken in high frequency currents and effects producible by them, it seems to me advisable to dwell at some length upon this method of conversion. In order to give you a clear idea of the action, I will suppose that a continuous current generator is employed, which is often very convenient. It is desirable that the generator should possess such high tension as to be able to break through a small air space. If this is not the case, then auxiliary means have to be resorted to, some of which will be indicated subsequently. When the condensers are charged to a certain potential, the air, or insulating space, gives way and a disruptive discharge occurs. There is then a sudden rush of current, and generally a large portion of the accumulated electrical energy spends itself. The condensers are thereupon quickly charged, and the same process is repeated in more or less rapid succession. To produce such sudden rushes of current it is necessary to observe certain conditions. If the rate at which the condensers are discharged is the same as that at which they are charged, then, clearly, in the assumed case the condensers do not come into play. If the rate of discharge be smaller than the rate of charging, then, again, the condensers cannot play an important part. But if, on the contrary, the rate of discharging is greater than that of charging, then a succession of rushes of current is obtained. It is evident that, if the rate at which the energy is being dissipated by the discharge is very much greater than the rate of supply to the condensers, the sudden rushes will be comparatively few, with long time intervals between. This always occurs when a condenser of considerable capacity is charged by means of a comparatively small machine. If the rates of supply and dissipation are not widely different, then the rushes of current will be in quicker succession, and this the more, the more nearly equal both the rates are until natural limitations incident to each case and depending upon a number of causes are reached. Thus we are able to obtain from a continuous-current generator as rapid a succession of discharges as we like. Of course, the higher the tension of the generator, the smaller need be the capacity of the condensers, and for this reason, principally, it is of advantage to employ a generator of very high tension. Besides, such a generator permits the attaining of greater rates of vibration.

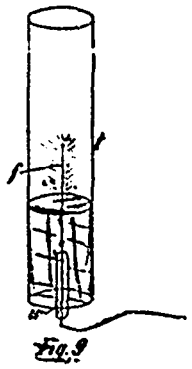

Fig. 9

SHOWING THE EFFECT OF THE AIR.

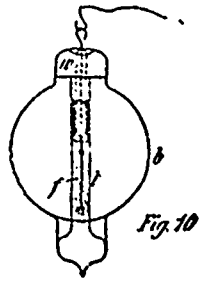

Fig. 10

SHOWING THE INFLUENCE OF THE CONDUCTIVITY OF THE MEDIUM UPON ELECTROSTATIC ACTIONS THROUGH MEASURABLE DISTANCE.

The rushes of current may be of the same direction under the conditions before assumed, but most generally there is an oscillation superimposed upon the fundamental vibration of the current. When the conditions are so determined that there are no oscillations, the current impulses are unidirectional and thus a means is provided of transforming a continuous current of high tension into a direct current of lower tension, which I think may find employment in the arts.

This method of conversion is exceedingly interesting and I was much impressed by its beauty when I first conceived it. It is ideal in certain respects. It involves the employment of no mechanical devices of any kind, and it allows of obtaining currents of any desired frequency from an ordinary circuit, direct or alternating. The frequency of the fundamental discharges depending on the relative rates of supply and dissipation can be readily varied within wide limits by simple adjustments of these quantities, and the frequency of the superimposed vibration by the determination of the capacity, self-induction and resistance of the circuit. The potential of the currents, again, may be raised as high as any insulation is capable of withstanding safely by combining capacity and self-induction or by induction in a secondary, which need have but comparative few turns.

As the conditions are often such that the intermittance or oscillation does not readily establish itself, especially when a direct current source is employed, it is of advantage to associate an interrupter with the arc, and I have, some time ago, indicated the use of an air-blast or magnet, or other such device readily at hand. The magnet is employed with special advantage in the conversion of direct currents, as it is then very effective. If the primary source is an alternate current generator, it is desirbale, as I have stated on another occasion, that the frequency should be low, and that the currents forming the arc be large, in order to render the magnet more effective

(To be Continued.)

LEGAL DECISIONS.

At Sherbrooke, Que., on August 18th last, in the case of C. A. Bissett, representing the Bell Telephone Co., vs C. Skinner *et al.*, representing the Sherbrooke Telephone Association, in which the defendants were charged with wilfully cutting telephone wires, the property of the plaintiffs', Judge Rioux gave judgment as follows:—

The defendants are charged with having wilfully cut eight wires of the Bell Telephone Company in Sherbrooke. The complaint is laid under Article 492 of the Criminal Code.

The facts proved at the Enquete show that the Bell Company had a line of poles on the north side of King street, existing there for several years, and located under the direction of a municipal officer, which poles supported a number of wires forming a part of their telephone system

That about the twentieth of July last, Mr Lemay an employee of the Bell Company put up more wires on these poles for the service of the company and before his work was completed on the 28th, one of the defendants, Pelletier, was instructed by the defendant, Skinner, under whom he works, to cut the wires of the Bell Company, and it was done eight wires were cut

It was claimed on the part of the defendants that these wires interfered with those of their company, and that they were justified in cutting them, at least, such appears to be the line of defence of the accused, from the cross examination of the witnesses.

It is shown that the lines of the two companies intersect each other on this street, near the Continental Hotel, and that is the point where the Bell lines were cut. The lines of the Bell Company were lotated on the poles above those of the Association, and in the space allotted by the charter of the company, viz., 22 feet from the ground.

By the Quebec Statutes of 1881, C. 76, power and authority were given this company to erect poles and construct lines of telephone under certain restrictions and regulations of the municipal officers. It is shown by the evidence of the men who worked in putting up these wires that they were of a sufficient height above the point of intersection with those of the Association, so as not to interfere with their wires in any way; and it is to be presumed, that if they touched them afterwards, it must have been caused by the Association having tightened their own wires, therefore causing them to raise, and come in contact with the Bell wires.

Whatever might have been the cause of the collision of the wires of the two companies, one thing appears to me certain, that is, the Bell Company, in this instance, were acting within their rights, in putting up these wires in the space allotted to them by the Statute, and as long as they remained within those strict rights, they should not have been interfered with by any other, without showing some authority to do so. I do not want to be understood to say, that the Bell Company has privileges in the City which another company cannot acquire by getting the proper act of organization, but what I do say is, that at present the Bell Company is the only company which has obtained the proper authority from the Legislature to construct their telephone system.

This is apparent by reading the report of the case, of the City versus The Sherbrooke Telephone Association, in the 19th volume of the *Revue Legale* page 538.

The Association in this present case have not shown, or ever attempted to show what rights they had, to put up wires and interfere with privileges obtained by their rivals—no Letters Patent, still less in any Statute, produced here, before me, to show their legal existence, so that in reality I am forced to decide between the rights of an Incorporated Company, shown to be such by Statute, and those of two persons (accused) who claim to act for another incorporated body, but whose legal existence is not proved, or even attempted to be proved. In the face of this, I cannot hesitate to find the proof sufficient to warrant me in sending the accused before the Court of Queen's Bench for their trial.

At the argument, the defendents have urged very strongly, (and it was even urged by them, that this was, in fact, the only point in the case,) that it was not proved by the prosecution that the wires cut were in active operation, but on the contrary were dead wires. I consider this objection futile, and the reading of Article 492 of the Criminal Code warrants no such interpretation, "Every one is guilty of an indictable offence who wilfully . . . destroys, removes or damages anything which forms part of . . . any telephone, etc. . . ." Can it be said, that because these wires were not yet connected with electric batteries, that they did not form part of the company's telephone system, and consequently any one had a right to cut them? It would be an outrage to reason, to argue so, as it would afford an easy way to a rival company to prevent competition by destroying the wires, as soon as they are put up, and before they are connected.

With regard to the proof of this cutting, having been done wilfully, there cannot be any doubt, according to the evidence, and according to the definition of this word by Art. 481.

In conclusion I may say, that whatever rights the Sherbrooke Telephone Association may show to have in this matter hereafter before another court, it is difficult to believe that they could take the law in their own hands, and be relieved of all responsibility of their actions.

SPARKS.

The electrical apparatus designed by Mr. Thomas Munroe, C. E., for operating the lock gates of the Beauharnois canal, has undergone satisfactory tests.

It is reported that the stock of the Galt and Preston Electric Street Railway Company is being rapidly taken up, and that the work of construction will shortly commence.

The Royal Electric Company has offered to establish works and give employment to 300 men at Cote St. Louis, on condition that the municipality will grant a bonus of $30,000.

The Guelph Light and power Company will hereafter furnish an all-night service at the request of their customers. Their incandescent lighting business is said to be rapidly increasing.

It is said that the Calgary Electric Lighting and Heating Company have been given the contract for lighting the streets of that city, and that their price for the work is the lowest in Canada.

Well deserved praise is being bestowed upon Mr. Brothers, the new superintendent of construction of the Montreal Street Railway, for the rapidity with which, under his direction, construction is being carried on.

There has reached us on the eve of going to press a kind invitation from Mr. Eugene F. Phillips to attend the fifteenth annual Rhode Island Clam Dinner tendered to the electrical fraternity by the American Electrical Works. The dinner will take place at Haute Rieve on Saturday next the 2nd inst., and we doubt not will prove quite as enjoyable as its predecessors.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

Note.—Secretaries of the various Associations are requested to forward us matter or publication in this Department not later than the 20th of each month.

THE FOURTH ANNUAL CONVENTION.

THE following programme of proceedings has been arranged for the Fourth Annual Convention of the Canadian Association of Stationary Engineers, to be held in Montreal on Thursday, Friday and Saturday, the 7th, 8th and 9th inst.

THURSDAY, SEPT. 7TH.

7.30 a.m. Reception of delegates at G. T. R. depot; escort to City Hotel for breakfast.

10 a.m. Opening session at Engineers' Hall Call to order Address of Welcome by District Deputy, Bro. Thos. Ryan Appointing Committee on Credentials. Short recess Report of Committee on Credentials. President's opening address Reading minutes of last meeting. Secretary's Annual Report Treasurer's Annual Report. Reports of Standing Committees Appointing of Auditors. Appointing Committees on Constitution, Correspondence, Good of the Order.

2 p.m.—Auditors' Report. Drive round the city and to the mountain top; then to the Exhibition by way of the cemetery. Lunch tendered by the directors of the Montreal Exposition Co.

7.30 p.m.—Open meeting. The public are cordially invited. Paper on "Waste Heat," by Bro. A. M. Wickens. Paper on "The Duties of Engineers Twenty Years Ago as Compared with the Present Day," by Bro. Chas. Kinsey.

FRIDAY, SEPT. 8TH.

10 a.m.—General Business.

AFTERNOON SESSION.

2.30 p.m.—Good of the Order. Adjourn at 4.15 to G. T. R. depot for Lachine, and home by the Rapids.

8.30 p.m.—Banquet.

SATURDAY, SEPT. 9TH.

10 a.m.—Election of Officers. Selection of next place of meeting.

2.30 p.m.—Paper on "Electric Motors," by Mr. W. B. Shaw. Paper on "Heating and Ventilation of Factories," by Bro. John J. York. Adjournment.

MONTREAL NO. 1.

At a recent meeting of the above Association, Brother Geo. Hunt, on behalf of Mr. G. W. Ingils, presented the Association with a valuable model of the Blake steam pump, and a complete set of blue prints, handsomely framed, of a 12,000,000 gallon Blake compound pumping engine. The members of the Association were enthusiastic in their appreciation of the valuable gift. A vote of thanks was passed to Mr. Ingils, who was also elected an honorary member. At the same meeting several large photographs of the Babcock-Wilcox boiler were presented to the Association by Mr. A. H. Holden. The photographs were expensively framed. A hearty vote of thanks was tendered to the donor.

TORONTO, NO. 1.

The above Association held their regular meeting on Aug. 11th, with President Watson Phillips in the chair. One member was initiated and an application for membership received. Under the head of "Good of the Order," the following questions were answered and illustrated on the blackboard by past-President Bro. Blackgrove:

(1). What would be the difference in percentage of strength of joint as compared with solid plate in the following joints: First, thickness of plate, 5-16"; diameter of rivet, ⅜"; pitch, 2.27"? Answer, 72%. Second, thickness of plate, 5-16"; diameter of rivet, 11-16"; pitch, 2.29"? Answer, 69.97%.

(2). Is there any advantage in making girth seams double rivetted? Answer, no!

(3). Is there any advantage in securing the flange of a dome by double rivetted joints? Answer, no!

(4). What size of boiler should be put in to heat a building containing 300,000 cubic feet of space and run a 10 h.p. engine? Answer, 30 h.p.

(5). What would be the safe working pressure of a boiler 60" diameter, 5-16" plate, joints same as first question above, 60,000 lbs. tensile strength Dalizell steel? Answer, 125 lbs. to the square inch.

On August 25th, the usual meeting was held, with Vice-President Butler in the chair. Two members were initiated and an application for membership received. The two alternate delegates, Bros. Sutton and Gilchrist, were asked to fill the places of Bros. Lewis and Phillips, who cannot attend the Convention of Engineers to be held in Montreal.

After the ordinary business was disposed of, a long discussion took place on questions that are expected to come before the Engineers' Convention, and final instructions were given to the delegates who are appointed to represent the Association.

CHAS. F. KINSEY,
Cor. Secretary.

NOTES FOR ENGINEERS.

STEAM boilers should have two safety valves, each one capable of discharging all the steam which the boiler can produce at the pressure to be controlled by the safety valves. The object of having two, is to diminish the risk of failure to act when the pressure rises. With only one valve, should that one stick to its seat, or fail in any other way, the boilers would be left without any protection from undue rise of pressure. It is not uncommon to have the one valve loaded so as to open at about 5 lbs. higher pressure than the other one. If the first one opens at 80 lbs. the other should open at 85 lbs. By this arrangement the action of each valve can be observed by the engineer with greater accuracy than if both opened at the same time. The higher the pressure, the smaller the valve needed to relieve the boiler. The steam making capacity of the boiler is dependent upon the size of furnace and amount of heating surface, but as all the heat comes from the furnace it is usual to make the area of the safety valve a definite proportion of the fire grate. For 60 lbs. pressure, *the safety valve should open one half a square inch* for each square foot of fire grate. For lower pressure the safety valve should be higher, and for higher pressure it may be smaller.

* * *

Scale and deposit forming inside of steam boilers are the cause of much anxiety to the engineer and may cause very serious loss of fuel. By scale is meant the hard formation usually of lime which adheres to the parts of the boiler in contact with the water. *By deposit is usually meant the accumulation of* sand or mud, or broken pieces of scale. A uniform deposit of scale is not nearly so dangerous as an accumulation of mud or sand. Nearly all water used to feed steam boilers contain lime or sand or some other admixture. When steam is formed and taken off, these impurities are left behind and gradually accumulate inside. A 50 H.P. boiler would use at least 9000 gallons of water in a week of 60 hours. If in each ten gallons of water there were half an ounce of solid matter, in a week's run as much as 28 lbs. weight would be left in the boiler. If this were to accumulate on the bottom or where the strong heat of the furnace was applied to the plates, they would soon become overheated, and be burned or buckled out of shape. To prevent this, the blow off cocks should be opened every day and the boiler should be opened and washed out at least once a month.

* * *

There are many different ways of firing steam boilers and each has its advocates who claim their method to be the best. The truth seems to be that *as coal varies in quality, so must its treatment* during combustion be varied, and what is best for one kind of coal will produce very poor results with other kinds. As a general rule, when the best results possible from a boiler are required, and the greatest amount of steam is wanted, the coal should be spread uniformly over the grate, and kept of an equal thickness throughout. The thickness may vary from about 5 inches to about 10 inches, and usually it will be found that a thin fire will give the best results, and requires most attention. If the coal is found to melt and to seal the bars, so that sufficient air does not get through, it will be an advantage, to shove the fire back on the grate and put the fresh coal in a heap on the front of the grate, where it will be coked and should then be shoved back and a fresh supply put on. The method of coking will be found the most economical way of burning coal, provided the boiler be large enough. Spreading the coal evenly makes the most out of the boiler. Coking the coal and then spreading it makes the most out of the fuel. When troubled with clinkers forming either on the grate bars, or on the sides of the furnace, *keep a little water in the ash pit. This will be found to preserve* the grate bars and prevent them from warping and will soften and break the clinkers, so that they can be easily removed.

* * *

To wash a boiler out properly, have it as cool as possible before beginning. If it is surrounded with brickwork get it cooled down. Open the blow off cock and blow out a little under pressure, so as to make sure that cock and pipes are clean. Then, when steam is down fill boiler entirely full of water. This can be *done by having connection with water works mains, or with* an over-head tank. Then with man hole cover off, and blow off cock open, wash out from above, using plenty of water, and as much pressure with it can be got. After that, remove the hand holes and scrape the bottom. The boiler should be kept wet inside all the time and not allowed to dry. Where there is much scale, it may be necessary to stop the water, and have a man go inside and break the scale off; but if a boiler is always washed out from the man hole and kept wet inside during the cleaning out, there will not be much scale to break off.

Every member of the C. E. A. who may come to Toronto on the 12th, 13th and 14th inst., will witness the best Electrical Convention and the greatest Industrial Exhibition ever held in Canada, the most interesting Electric Railway, the greatest source of Power and the greatest engineering scheme for the utilization of that power to be found in the world, and at the least possible cost. Will you take it in?

CANADIAN ELECTRICAL NEWS AND STEAM ENGINEERING JOURNAL

PUBLISHED ON THE FIRST OF EVERY MONTH BY

CHAS. H. MORTIMER,

OFFICE: CONFEDERATION LIFE BUILDING,
Corner Yonge and Richmond Streets,
TORONTO, - - CANADA.
Telephone 2362.

64 TEMPLE BUILDING, - MONTREAL.
Bell Telephone 2299.

ADVERTISEMENTS.

Advertising rates sent promptly on application. Orders for advertising should reach the office of publication not later than the 15th day of the month immediately preceding date of issue. Changes in advertisements will be made whenever desired, without cost to the advertiser, but to insure proper compliance with the instructions of the advertiser, requests for change should reach the office as early as the 22nd day of the month.

SUBSCRIPTIONS.

The ELECTRICAL NEWS will be mailed to subscribers in the Dominion, or the United States, post free, for $1.00 per annum, 50 cents for six months. The price of subscription may be remitted by currency, in registered letter, or by postal order payable to C. H. Mortimer. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters must be at senders risk. Subscriptions from foreign countries embraced in the General Postal Union, $1.50 per annum Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

Subscribers may have the mailing address changed as often as desired. *When ordering change, always give the old as well as the new address.*

The Publisher should be notified of the failure of subscribers to receive their papers promptly and regularly.

EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics coming legitimately within the scope of this journal.

THE CANADIAN ELECTRICAL NEWS HAS BEEN APPOINTED THE OFFICIAL PAPER OF THE CANADIAN ELECTRICAL ASSOCIATION.

CANADIAN ELECTRICAL ASSOCIATION.

OFFICERS:

PRESIDENT:

J. J. WRIGHT, Manager Toronto Electric Light Company.

1ST VICE-PRESIDENT:

K. J. DUNSTAN, Local Manager Bell Telephone Company, Toronto.

2ND VICE-PRESIDENT:

JOHN CARROLL, Sec-Treas. Eugene Phillips Electrical Works, Montreal.

SECRETARY-TREASURER:

C. H. MORTIMER, Publisher ELECTRICAL NEWS, *Toronto.*

EXECUTIVE COMMITTEE:

D. A. STARR, Royal Electric Company, Montreal.

H. O. FISK, Electrician Electric Light Company, Peterboro', Ont.

W. A. JOHNSON, Manager Ball Electric Light Company, Toronto.

S. J. PARKER, Managing Director Owen Sound Electric Light Company, Owen Sound, Ont.

A. R. SMITH, Inspector Canadian Board Fire Underwriters, Toronto.

D. THOMSON, General Manager Hamilton Electric Light and Power Company, Hamilton, Ont.

THOS. H. WADLAND, Superintendent Construction, Bell Telephone Company, Hamilton, Ont.

L. R. McFARLANE, Bell Telephone Company, Montreal.

JOHN YULE, Manager Guelph Gas and Electric Light Company, Guelph, Ont.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

EXECUTIVE BOARD:

President A. E. EDKINS,	Toronto, Ont.
Vice-President, G. HUNT,	Montreal, Que.
Secretary, W. G. BLACKGROVE,	43 Brant St., Toronto.
Treasurer, R. MACKIE,	Hamilton, Ont.
Conductor, CHAS. HEAL,	Toronto, Ont.
Door Keeper, F. Brisbois,	Montreal, Que.

TORONTO BRANCH NO. 1.—Meets 2nd and 4th Friday each month in Room D, Shaftesbury Hall. W. G. Blackgrove, President. G. Fowler, Secretary, 137 University street.

HAMILTON BRANCH NO. 2.—Meets 1st and 3rd Friday each month, in Maccabee's Hall. W. Sweet, President; Wm. Norris, Secretary, 211 Wellington Street North.

STRATFORD BRANCH NO. 3. John Hoy, President, Samuel H. Weir, Secretary.

BRANTFORD BRANCH NO. 4.—Meets 2nd and 4th Friday each month. Thos. Pilgrim President, John Ogle, Secretary, Brantford Cordage Co.

LONDON BRANCH NO. 5.—Meets in Sherwood Hall first Thursday in each month. F. Mitchell, President, Geo. Taylor, Secretary Treasurer, 356 Piccadilly Street.

BRANDON, MAN., BRANCH NO. 1. Meets 1st and 3rd Friday each month, in City Hall. A. R. Crawford, President; Arthur Fleming, Secretary.

MONTREAL BRANCH NO. 1.—Meets 1st and 3rd Thursday each month, in Mechanics Institute, 204 St. James street. President, Jos. Robinson; first vice president, H. Nuttall; second vice-president, Jos. Badger; secretary, J. J. York, Board of Trade Building; treasurer, Thos. Ryan.

ST. LAURENT BRANCH NO. 2.—Meets 1st and 3rd Tuesday each month, in Mechanics' Institute, 204 St. James street. Matthais Guimond, President; Alfred Latour, Secretary, 306 Delisle street, St. Cunegonde.

GUELPH BRANCH NO. 6.—Meets 1st and 3rd Wednesday each month at 7:30 p.m. J. A. Angell, President; C. Jorden, Secretary.

OTTAWA BRANCH, NO. 7.—Meets 2nd and 4th Tuesday, each month, corner Bank and Scott streets; J. H. Thompson, President; Wm. O'Brien, Secretary.

DRESDEN BRANCH NO. 8.—Meets every 2nd week in each month; Thos. Merrill, Secretary.

BERLIN BRANCH NO. 9.—Meets 2nd and 4th Saturday each month at 8 p. m. W. J. Rhodes, President; G. Steinmetz, Secretary, Berlin Ont.

KINGSTON, ASSOCIATION STATIONARY ENGINEERS.—Meets twice each month over No. 1 Fire Station. J. Devlin, President; W. Gilmour, P. O. Box 699, Secretary.

ONTARIO ASSOCIATION OF STATIONARY ENGINEERS.

BOARD OF EXAMINERS.

President, A. E. EDKINS,	139 Borden st., Toronto.
Vice-President, R. DICKINSON,	Electric Light Co., Hamilton.
Registrar, A. M. WICKENS,	280 Berkeley st., Toronto.
Treasurer, R. MACKIE,	28 Napier st., Hamilton.
Solicitor, J. A. MCANDREWS,	Toronto.

TORONTO—A. E. Edkins, A. M. Wickens, E. J. Phillips, F. Donaldson.
HAMILTON—P. Stott, R. Mackie, R. Dickinson.
PETERBORO'—S. Potter, care Edison General Electric Co.
BRANTFORD—A. Ames, care Patterson & Sons.
KINGSTON—J. Devlin (Chief Engineer Penetentiary), J. Campbell.
LONDON—F. Mitchell.

Information regarding examinations will be furnished on application to any member of the Board.

THE unsettled state of business in the United States has had a depressing effect on the mica mining industry in the Ottawa district. In this connection we are pleased to notice that Dr. Selwyn, director of the Geological Survey, emphatically denies the published statement to which we referred in our last issue, that the exhibits of Canadian mica at the Columbian Exposition were much inferior to those of India and Australia. Dr. Selwyn declares that Canada has by far the best exhibit of mica at the Fair, and that the only crystals exhibited are those from Canada.

A COMMITTEE of the municipal council of the city of Glasgow has recommended that the telephone business be conducted in future by the municipality instead of by the National Telephone Co., as heretofore. The latter company, in a statement published in a Glasgow paper, points out the injustice which would result from taxing a population of 700,000 people in order to slightly reduce the cost of service to a few thousand telephone users. Municipalization has already been adopted in an extensive degree in Glasgow, the waterworks, gas, electric light and tramway systems being already under civic control.

IN Ottawa the electric cars are being utilized to carry the mails to the railway depots. This will no doubt prove to be but one of numerous uses which electric cars will eventually be made to serve. It has been proposed to utilize cars built for the purpose to convey during the night the sweepings and other refuse from city streets. The question of cost is of course one of prime moment. Should it be found as inexpensive to employ electric cars as horses and carts, the former may at an early date be expected to supersede the latter. It may be regarded as certain that the possibilities of the electric railroad will be found not to be limited to the business of carrying passengers.

In the present issue will be found the first instalment of Mr. Nikola Tesla's remarkable lecture on "Light and Other High Frequency Phenomena," delivered before the Franklin Institute and the National Electric Light Association of the United States. The publication of this lecture, which is accompanied by numerous illustrations, will probably extend over three successive issues of THE NEWS. In this lecture Mr. Tesla has demonstrated several new and startling theories with regard to the character, and operation of electric currents, and has indicated future developments on the line of their application to practical uses, the fulfilment of which would be but slightly less wonderful than what has already taken place. Mr. Tesla is regarded as perhaps the ablest and most original experimenter in the field of electricity at the present time, and the most likely source from which future discoveries may be expected to emanate. Every student of electricity should therefore study and seek to thoroughly understand the theories and facts set forth in the lecture which we publish, and carefully preserve the copies of THE NEWS containing the same for future reference.

WE wish to call the attention of our correspondents to the fact that the name and address of the writer must accompany every communication in order to insure its insertion. This is a well known journalistic rule, and one which is necessary for the protection of the publisher. Some of our correspondents in asking for information have overlooked this requirement. Apparently they have omitted their name because they did not wish it to appear in print. To such we may say that although the name is required by the publisher for his protection, it does not follow that the same will be printed with the communication. The correspondence may appear over a *nom de plume* if so desired but the actual name and address of the author must be in the editor's possession.

MOST engineers of experience will recognize the truth of the following from the columns of the *Canadian Manufacturer*. It may seem strange to the uninitiated, but it is a fact well known to those who have been through the mill, that owners of steam boilers do not always encourage their engineers to report defects in them, but on the contrary try to bulldoze them into silence on the subject, by threatening them with a loss of their situation, and it sometimes does happen that a man is discharged for reporting such defects, or leaves the place because he cannot have them repaired, in which case there is always some reckless ignoramus ready to take the chances of disaster by keeping it in operation, and there is always someone willing to recommend him for the situation. Let us have laws passed requiring manufacturers to take out licenses permitting them to own steam boilers after they have proved themselves to be fit persons to own such property for they are needed as much as license laws for engineers are, and perhaps more.

IN the August number of THE NEWS a correspondent asked for information regarding the means and cost of obtaining an engineer's certificate. For the information of this correspondent and of others of our readers who may desire it, we now amplify somewhat the answer which we published in last issue, on the above subject. First of all it should be said that there are two associations of Canadian engineers, viz., the Canadian Association of Stationary Engineers and the Ontario Association of Stationary Engineers. The C. A. S. E. is an educational society and does not grant certificates. The O. A. S. E. have the power to grant certificates under an Act passed by the Ontario Legislature, April 30th, 1891. The cost of these certificates, as before stated, is as follows: for a 1st class, $5.00; 2nd class, $3.00; 3rd class, $2.00. The certificates are to be renewed at the end of each year. The price of renewal is, for a 1st class, $1.50; 2nd class, $1.25; 3rd class, $1.00. If a certificate holder gets intoxicated, or through carelessness breaks his engine, the Board of Examiners will refuse to renew his certificate. The persons wishing to obtain a certificate should write to the Registrar of the Association or to the member of the Board of Examiners residing nearest to his locality, who will make the necessary arrangements for his examination. There is no stated place or time fixed for such examination, but the convenience of the applicant is consulted in these particulars. The names of the officers of the association and of the Board of Examiners are given in each issue of THE NEWS. If a candidate applies for a first-class certificate and fails to pass the required examination, the price of a first class certificate is put to his credit, and he may come up for examination again as often as is necessary without extra charge until he secures his certificate. To become a member of the C. A. S. E., the applicant must pass an examination or present a certificate from the O. A. S. E., which will be accepted in lieu of an examination. The initiation fee is $5.00, and the dues 50 cents per month. It is not a labor organization but an educational society, and has proved most helpful to its members, many of whom are now holding good positions as the result of the knowledge gained at its meetings.

The Electrical Industry is rapidly assuming a position of great importance in Canada. The Canadian Electrical Association seeks to promote its progress and conserve its welfare, and is consequently deserving of the support of every person connected with or interested in electrical matters. All such persons are invited to be present at the Convention on the 12th, 13th and 14th inst.

CANADIAN ELECTRICAL ASSOCIATION.

BELOW will be found printed the programme of the Third Convention of the above Association, to be held on the Toronto Industrial Exhibition Association's grounds, on Tuesday, Wednesday and Thursday, the 12th, 13th and 14th inst. The papers are now in the hands of the Secretary, and copies of them are being printed. These printed copies will be placed in the hands of members at the Convention prior to being read by the authors, thus affording opportunity for intelligent discussion. Applications for membership are coming in, and all the indications point to a well attended and interesting meeting. The programme is as follows:

TUESDAY, SEPT. 12TH

2 p.m. —President's Address.
Secretary-Treasurer's Report.
Report of Committees.
General Business.
Paper by Mr. Fred. C. Robertson, Toronto. Subject. "Some of the Causes of Interruption to Telegraph Circuits."
Paper by Mr. A. C. McCallum, of Peterboro'. Subject: "Water Wheels."

WEDNESDAY, SEPT. 13TH

10 a.m. —Nomination and Election of Officers, and selection of place of next meeting.
Unfinished Business.
Paper by Mr. J. B. McFarlane, of Montreal. Subject: "The History of the Telephone in Canada."
Paper by Mr. E. B. Merrill, Toronto. Subject: "Electrical Education."
Paper by Mr. John Langton, Toronto. Subject. "Direct Connected Dynamos and Steam Engines."
Paper by Mr. E. Carl Breithaupt, of Berlin, Ont. Subject: "Electric Street Railways."

THURSDAY, SEPT. 14TH

7 a.m. Steamer of Niagara Navigation Company to Queenston.

By courtesy of Mr. W. A. Grant, Manager, a special car will be taken on the Niagara Falls Park and River Electric Railway from Queenston to Chippewa, and inspection made of the power house and plant.

Also by invitation of Capt. Carter, the members will visit the Falls at Table Rock and Prospect Park, the works in the Tunnel District, the Tower, etc., and take a trip around the Falls on the Steamer "Maid of the Mist." Luncheon will be provided at the Cliff House, and dinner on the boat during the return trip.

Members of the Association in good standing will receive tickets covering the above, without cost to themselves, upon application to the Secretary. Ladies' tickets may also be obtained by members for $1.50 each.

PERSONAL.

Mr. C. W. Hurlburt, formerly with the G. N. W. Telegraph Company, Montreal, has been appointed to succeed Mr. A. Bennett as editor of telegraphic dispatches at Toronto.

Professor Cams Wilson, of the electrical engineering department of McGill University, is about to be married in England to Miss Mary Louisa Georgina Petrie, B.A., of Hanover Lodge, Kensington Park.

We learn that Mr. Fred. Thomson has severed his connection as electrician with the Royal Electric Company, of Montreal. Mr. Thomson is at present visiting the World's Fair. It has not been learned what his future course of action is to be.

Mr. A. C. McCallum, of Peterboro', whose paper on "Water Wheels" forms a feature of the programme of the approaching C. E. A. convention, has recently become a Benedict. THE ELECTRICAL NEWS extends to Mr. and Mrs. McCallum its best wishes for a long and prosperous matrimonial voyage.

Mr. Fred G. Mitchell, of London, has been appointed inspector for the Boiler Inspection and Insurance Co., of Toronto. We doubt not he will prove himself well qualified for the position. Mr. Mitchell is one of the most active members of the C. A. S. E. in London, and as such will be greatly missed.

THE ELECTRICAL NEWS received a visit recently from Mr. W. A. Turbayne, electrician of the Turbayne Tamblyn Company, of Detroit, Mich., manufacturers of arc lamps and electrical specialties. Mr. Turbayne, who was formerly a resident of Toronto, states that his company may possibly establish an agency in Canada.

Mr. R. A. Ross, electrical engineer, and Mr. C. Legrand, tester, have severed their connection with the Canadian General Electric Company's Works at Peterboro', and were tendered a farewell supper by their associates on the eve of their departure. Mr. Ross has accepted a position with the Royal Electric Company, Montreal.

For some time past Mr. Wm. Wylie, assistant manager of the City and Suburban Street Railway, Toronto, has been in a critical condition of health as the result of blood poisoning, due to having scratched his finger with a rusty nail. At times he was unconscious and but slight hopes were entertained of his recovery. We are pleased to learn, however, that he is now considered to be out of danger.

It is with much regret that we learn of the retirement of Mr. Dan. Thomson from the management of the Hamilton Electric Light and Power Company. The change is due to the unprofitable condition of the Company's business, which has rendered necessary an attempt to curtail expenses. In common with Mr. Thomson's many friends we shall be pleased if an opening presents itself in Canada for his services. He is undoubtedly one of the most capable electricians in this country, and should if possible be retained here.

QUESTIONS AND ANSWERS.

R. S. M., writes: How many "watt hours should seven incandescent lamps of 16 c. p. consume per hour, and does the current passing from one lamp, effect a meter proportionately to the 6 others not burning? To explain why I ask the question I may say that I have recently occupied a store fitted with electric lamps (7) as above described, and in two weeks have used 9000 watt hours. The actual time of burning was not more than 18 hours, and I concluded that the meter must be at fault, or that the charges in comparison to lamp per month were excessive. I would like if you could give me the rates that are charged in oteer places where meters are used.

ANS: The kind of lamp used would affect to a considerable extent the number of watts of current consumed per hour; the average however, is about 60 for a 16 c. p. lamp. The meter if a good one, should measure one lamp justly as exactly as seven. Of course an increase in the voltage, from any cause, would tend to increase the brillancy of the light, and consequently the number of watts registered; but with a constant voltage, the consumption of current should be recorded exactly, with any load. Some lamps are more economical than others, and this may have something to do with the matter, The rates for current supplied by watt meter, range from 13 to 20 cents per 1,000 watts. The usual price is about 15 or 16 cents with a small discount for cash payment.

AN Ottawa correspondent asks. (1.) Is there a rule to find the temperature of steam at any pressure?

ANS. The general result of experiments shows that the pressure increases as the temperature is increased, but the incsease is not uniform. At 212 the pressure is 14·7 lbs., and the rise of pressure is about 29 lbs. for each degree of tempera ture At 300° the pressure is 67·22 lbs., and each degree of temperature adds 1 lb to the pressure. Many formulæ have been proposed to show this, but for all practical purposes it is much better to use some one of the published tables found in Engineering works, giving the relative properties of saturated steam. One of the simplest formulæ, suggested by Mr. W. M. Buchanan, and used by Dr. K. Clark, is as follows:

$$t = \frac{2938.16}{6.1993544 - \log p} = 371.85.$$

where t = the temperature in degrees Fah. and p = pounds per sq. inch.

(2.) How to find the relative volume of steam at different pressures?

ANS: There have been very few reliable experiments made to determine this relation. The most reliable were made more than 30 years ago and published in a paper read by Sir Wm. Fairbairn before the Royal Society in 1860. The formulæ given by Fnirbairn is:

$$v = .41 + \frac{389}{p + .35}$$

where v = volume in cubic feet.
and p = pounds per sq. inch.

(3.) How to find the total heat of steam at any pressure?

ANS: The total heat of saturated steam is the sum of its latent and sensible heat, and it is usual to assume that the steam is produced from water of 32° Fah. The total heat then, represents the amount of heat which has been added to water of 32° in order to produce steam of the pressure given. First find the temperature corresponding to the pressure, then let
t = the temperature.
h = the total heat.
h = 1081.4 + ·305 t.

(4.) How to find the velocity of draught from inches of water?

ANS: Velocity of draught may be measured by inches of water indicating the difference of pressure which is causing the draught.

An approximate formulæ is: v = vp × 102.
That is, the velocity of draught in feet per second is equal to the sqare root of pressure in inches of water multiplied by 102.

MONTREAL ELECTRIC CLUB.

AN informal meeting of some of the officers of the above Club was held at the residence of J. A. Farlinger on Wednesday night last, at which it was decided, owing to the success of the Club last year, that it be called together again. The first meeting will take place at the old rooms, usual hour, on Monday, Sept. 11th.

It is the intention of the Club to have an exhibition of apparatus, added to the items for each evening, which will no doubt prove an interesting adjunct to the proceedings.

New by-laws will be drafted the coming winter, and new regulations regarding admitting new members, so as to give the Club a wider scope, at the same time keeping it strictly within electrical bounds.

Many new applicants are expected, and the Club look for a successful winter session.

Will Niagara Falls be your objective point on the 14th inst.?

CORRECTION.

Ed tor ELECTRICAL NEWS.

DCAR SIR:—I have noticed the following item in the August issue of the CANADIAN ELECTRICAL NEWS:

"Owing to the trouble that has been experienced by the Toronto Street Railway with the Edison motors heretofore in use, the manager has decided to replace them with Westinghouse motors at a cost of about $50,000."

I beg to inform you that your information is quite incorrect as we are not replacing the Edison motors and have recently awarded the Canadian General Electric Company a contract for one hundred Thomson-Houston W.P. 50 motors,

Yours truly,

WM. MCKENZIE,
President Toronto Railway Company.

DANGEROUS STEAM PLANTS.

Editor CANADIAN ELECTRICAL NEWS.

SIR,—A short time ago, I had occasion, while waiting for a train, to spend some time at a station west of London on the G. T. R. As usual I commenced to look around me for smoke stacks, and finally located three; and not far away either. I made my way to one place which turned out to be a flour mill, and on entering found a gentleman, who turned out to be proprietor, miller, book-keeper and engineer of the establishment.

After some conversation, I expressed a wish to see the steam plant, and was conducted to the engine room. On arriving there I found an old slide valve engine hammering away. The flange joints of steam pipe and steam chest cover were packed with pieces of shingles. The result was a sound resembling that produced by some of our city fife-and-drum bands at the 12th of July period. I noticed water and steam flying out of something at the front of the boiler, and upon investigating more closely, found a 1½" blow-off cock on a pipe; instead of the brass plug being in the cock, there was a wooden plug driven in, and this was what was leaking. I looked up at the steam gauge and saw that it registered 70 lbs. I suddenly took a notion to go up stairs, and advised the "engineer" on my way up, to put on a new blow-off cock, but he said it was all right, and he wasn't afraid. He also told me that the old boiler in this mill exploded a few years ago and killed the engineer and blew the end of the mill down. I advised him to be careful, or the new boiler might scald him some day.

I afterwards saw the remains of the boiler which exploded near Petrolea short time ago, killing the engineer and a machinist who was repairing the engine. I believe if this boiler had been inspected that it would have been condemned long before the time of the explosion, and two lives would have been saved.

Yours, &c.,

TRAMP.

TRADE NOTES.

The Penberthy Injector Company of Detroit, have issued the first number of the "Penberthy Bulletin," which is devoted to information regarding their appliances.

Messrs. Darling Bros., of Montreal, have issued in pamphlet form a list of Morse Valve Machines sold by them in Canada, and also a number of excellent testimonials from purchasers who have given them a thorough and satisfactory trial.

The Royal Electric Co. have lately shipped to Pueblo Principe, Cuba, two 750 light alternators, with the necessary station apparatus, transformers, lamps, etc. This is claimed to be the first shipment to foreign parts of Canadian manufactured electrical machinery.

The Royal Electric Company of Montreal, have purchased from the Robb Armstrong Company of Amherst, N. S., a 75 h. p. Monarch Economic boiler and a Robb Armstrong automatic engine, to be used in the operation of the electric light plant at Montreal Junction.

The Magnolia Metal Company, which sells its metals all over the world, extends to its friends an invitation to visit its exhibit at the World's Fair, it can be found at Section No. 10, Column No. E-53, where all people who are interested in the running of machinery with the least amount of friction are welcome.

The Dodge Wood Split Pulley Company, of Toronto, have recently equipped with their well known split pulleys, the Rathbun Company's mill at Campbellton, Ont., the Waterloo Woollen Company's mill, at Waterloo, Ont., J. & J. Black's mill at Thurso, Que., and Geo. Matthews Packing Company's establishment at Peterboro'.

Mr. T. W. Ness, manufacturer and dealer in electrical supplies, 249 Craig street, Montreal, has found it necessary to enlarge his buisness, and with this object has taken into partnership Messrs. P. H. Davidson, J. E. Adams, James L. Rakin and N. W. McLaren. Mr. Davidson for a number of years past had charge of the books, in the old firm. Mr. Rakin was formerly interested in real estate, and Mr. McLaren was proprietor of the Montreal Sign Works. The new members will bring with them into the Company new capital, and are known to be active workers, so that the business may be expected to steadily increase.

We learn that Messrs. Ahearn & Soper, of Ottawa, are making a specialty of low-period, two-phase machines, such as are supplying current for all the incandescent lighting at the Chicago Exposition. These machines are 15,000 light capacity each, and of periodicity of 50 per second. They are operating incandescent, arc light and two-phase A. C. motors from the same circuit. Messrs. Ahearn & Soper are now offering a full line of slow speed low-period alternators, for example, a 1,200 light machine has a speed of only 600 revolutions, a 900 light machine runs at 720 and a 600 light machine at 900. Being low-period it is possible to run both arc and incandescent lights with the same degree of ease. The armatures are removable.

The St. Clair Tunnel Company are receiving estimates for the electrical equipment of their line through the tunnel, with the object of avoiding the smoke from the locomotives, which is having an injurious effect upon the tunnel.

THE INTERNATIONAL ELECTRICAL CONGRESS.

By E. B. Merrill.

On Monday the 21st of August and the four succeeding days, there met in Chicago an International Electrical Congress which is likely to form a landmark amongst such meetings for many years to come. It was composed of electrical men from nearly all the civilized countries of the world and contained an inner circle known as the "Chamber of Delegates," which consisted of those specially designated by the various governments to represent them, and whose business it was to consider the adoption of electrical notation and standards and the definition of units with a view to recommending the legalizing of the same.

The Congress met in the Art Institute where other engineering or scientific congresses had also been held or were then in progress. The choice of the building was rather unfortunate for such important work, as it is located on the lake front and immediately behind it, between it and the lake, are a large number of tracks of the Illinois Central, so that during the whole course of the meetings there were continual interruptions from the puffing and hissing of the locomotives and the rumbling and rattling of the trains rushing through or being shunted here. It taxed to the utmost the vocal powers of those that read papers or took part in the discussions, and was often the cause of only partially filled rooms when the readers of papers were lacking in sufficient lung power. They say that Demosthenes rehearsed his oratory to the dashing waves on the sea shore; what a grand opportunity for cultivation he missed in not being born a few centuries later, and in Chicago.

The first meeting opened at about 4 o'clock in Columbus Hall, a large amphitheatre in the northern part of the Institute; and when Prof. Elisha Gray, of tautolograph fame, rapped the official gavel, he found before him a large and representative gathering of electrical men from all parts of the world, and when he invited the official delegates to the platform, there appeared such a galaxy of celebrities about him as perhaps has never before been seen in America. Most conspicuous amongst them was the venerable Helmholtz who has done so much for science in Germany. Then there were representing Great Britain Dr. S. P. Thomson, W. H. Preece, Prof. W. E Ayrton and Alexander Siemens, all familiar names in electricity; representing France, Professors E. Mascart and E. Hospitalier; from Germany, Dr. H. Von Helmholtz and Dr. E. Voigt; from Switzerland, Dr. A. Paloz and M. Thury; from Italy, Prof. Galiler Ferraris; from Austria, Dr. Johann Sahulka; and from the United States, Professors H. A. Rowland, Elihu Thomson, H. S. Charhart and Dr. T. C. Mendenhall. Other delegates arrived later during the course of the meetings.

The sight of so much talent here congregated was one long to be remembered. One was sorry, however, not to see the faces of Lord Kelvin, perhaps the king of them all, of the wizard Edison, and of that later advent of genius, Tesla.

After a speech from the chair welcoming the delegates and members of the Congress, organization was proceeded with, and pending the announcements of special committees, there were speeches by Helmholtz, Ayrton, Elihu Thomson, Preece, Mascart (in French), Mendenhall, &c.

Permanent officers were elected, Helmholtz being made Honorary President, and Gray, Chairman. A Vice-President from each country represented was also elected. The Congress then adjourned to meet the next and following days, between the hours of 10 a.m. and 1 p.m., in three sections, that of pure theory, of mixed theory and practice, &c., and of true practice, all sitting simultaneously, rather an unfortunate disposition as afterwards appeared. Perhaps a better arrangement would have been to have a large room for papers of general interest and to have the meetings held, as they were, in the mornings, and to have papers, representing special interests mainly, referred to their own sections to meet in the afternoons or evenings. As it was, nearly all the papers would have been at home in section B. We were a little surprised that in an electrical gathering the management of the time table should have been so unsystematic. The dates for the reading of particular papers were entirely conjectural, so that it kept a member continually on the *qui vive*, dodging from section to section to hear the papers of most interest to him, and perhaps he would retire from an interesting discussion in one section, hasten to another and find that a paper he had desired to hear had been completed, or that he had lost the discussion on another. Of course these papers may be had in print hereafter, but it is likely to be several months before they are obtainable, and in that time they have lost much of their freshness and interest, and the opportunities for discussing them to so great advantage no longer exist.

The work of the sections proceeded from day to day in the rooms allotted to them. The attendance in section A was naturally small, the discussions there being in differentials and vectors. The main part of the Congress alternated between sections B and C, according as the papers in the one or the other were of more general interest. Those that excited the greatest discussion were on "Electromagnetic Signalling Through Space," "Ocean Telephony," "Direct Current Dynamos of Very High Potential," "Long Distance Transmission by Various Systems," "The Conversion of Alternating into Continuous Currents and the Reverse," and "The Arc Light." Owing to the time consumed by some of these papers there were quite a number towards the end of the lists that were only read by title or by a short synopsis, and discussion was greatly abbreviated.

The Congress met finally on Friday afternoon at 3 o'clock in Columbus Hall to hear the report of the delegates. They had held frequent deliberations in private during the week.

The report recommended the adoption of the names that are now in general use of the more elementary electrical units and defines them according to theory and the best practical way of obtaining them according to the results of the best scientific investigators. The higher units remain without names, except ing the designations of the G. C. S. system. Other questions were left in the form of appeals to the scientists of all nations to carry on further investigations and discussions upon them. The principal were concerning notation and nomenclature, and the adoption of a standard of light. The opinion was that no light so far obtained and defined shows sufficient definiteness under known conditions to be taken as a standard.

The Congress then adopted the report and after the announcing of the programme for the further entertainment of the members at the World's Fair, adjourned.

On Friday evening, August 25th, as a treat to the members of the International Electrical Congress, which had been holding its meetings during the week in Chicago, a lecture by Nikola Tesla was given in a room in one of the buildings in the World's Fair grounds. There was a large attendance of members and their lady friends, and the greatest interest was shown by the close attention paid to the experiments and explanations given, and by the hearty applause. The subject matter was on a means of producing mechanical vibrations and the application and the construction of a dynamo with vibrating instead of rotating armature and the nature of the results and their applications.

Mr. Tesla is a pleasant speaker, though not yet free enough with his English to speak very rapidly, and is troubled with neither self-consciousness nor egotistic self-assertion.

His work in this line is still in the experimental stage, but he is very hopeful of good results.

He is so interested in his work and devotes so much time to it that he is in danger of injuring his health. This is greatly to be regretted, as the world should have much to receive yet from the fertile brain of this young inventor.

If you are not a member of the Canadian Electrical Association, send in your application at once, and be elected in time to take part in the Convention at Toronto on the 12th, 13th and 14th.

The Canadian Rubber Company, of Montreal, have commenced the construction of a four story brick and stone warehouse at Winnipeg, at a cost of $12,000.

ELECTRIC RAILWAY DEPARTMENT.

CHANGES INDUCED BY ELECTRIC CARS.

WITH the introduction of electric railways there have come several important changes in former conditions. Persons whose means would not permit them to keep a horse and carriage are now able to enjoy the luxury of being transported to all parts of the city and suburbs at a trifling cost. These changed conditions have also led many persons to dispose of their horses and carriages and thereby effect a saving of several hundred of dollars per year. On the other hand, the introduction rapid electric transit has proved a severe and almost fatal blow to the hack owners. People who can reach their destination speedily and comfortably in an electric car at a cost of four cents will of course decline to pay a dollar for a hack. The city of Ottawa furnishes an illustration of the effect of the change of conditions upon the hack business. In 1890 the number of licensed hackmen in that city was 198. In 1892 the number had decreased to 127, and this year the shrinkage will be considerably greater still.

RIGHTS OF STREET CARS AT CROSSINGS.

THE Supreme Court of Minnesota has ruled that a street railway car has no priority of way at a street crossing with respect to other vehicles, and when the driver of such another vehicle, approaching the street railway track to cross it, sees a car approaching at such a distance that he can, apparently, make the crossing safely, he has a right to attempt it, and it is not negligence per se in him to attempt it without looking a second time at the car. Upon such travelled tracks in a city it is negligence to run an electric street railway car over a crossing at a high and dangerous rate of speed. And it is also negligence to run it over a crossing, the person in charge of it not being on the lookout, not having the car under control, nor using the proper means to stop it so as to avoid a collision.

ELECTRIC RAIL WELDING.

The operation of welding by electricity the rails of the West End Company in Cambridge, Mass., is attracting a great deal of attention, and interested crowds are constantly on the spot, pushing for vantage ground from which to see the machine at work, and speculating as to how it is done. Many and strange are the theories and explanations advanced by the "knowing ones," the usual quota of whom are always present, says N. Y. *Electrical Review*, and the fragments from this source which occasionally reach the ears of the men employed, contribute greatly to their amusement.

The machine has now been in operation for about a week, and a considerable stretch of track has already been covered, though better progress will be made from now on, as the men are becoming more familiar with the work as it progresses, and are handling it more rapidly in consequence. The system is one devised by the Johnson Company, of Johnstown, Pa., and while they have already done some amount of similar work on their own lines in Pennsylvania, the present contract is the first that has been attempted for outside parties, and the machine now in use is the first one constructed.

The apparatus consists of a box car open at one end to admit of the free operation of the crane which supports the welder, and by means of which it is moved from side to side and placed in position. The opposite end of the car is occupied by a 250 horse-power motor dynamo, manufactured by the Thomson Electric Welding Company, of Boston, by means of which the 500 volt direct current taken from the overhead wires is transformed into an alternating current of about 500 amperes, and passed into the transformer located in the base of the welder, from which it is applied to the rails at 50,000 amperes. The car is also supplied with two 25 horse-power Thomson-Houston railway motors for operating it on the tracks, and contains water tanks with a capacity of 500 gallons. This water is kept in constant circulation by means of a small pump, and passes through rubber pipes to the copper contact pieces of the welder, keeping them always cool. The welder itself is a massive affair weighing four tons, and is suspended from the crane immediately over the joint to which it is to be applied. It is fitted with two immense jaws which grip the rail on either side after the steel spanners have been put in position. These jaws are operated by a toggle joint worked by a right and left handscrew. By this means one man is able to apply a pressure of 40,000 pounds.

When the joint is held in this vise-like grip the current is turned on, and in a few seconds the rails at the point of contact begin to glow and are soon at a white heat. By this time the joint is closed up and the steel pieces on either side, under the immense pressure, have become a part of the rail itself. The current is then turned off, the grip loosened, and the car moved forward to the next joint.

The crane supporting the welder was built by Yale & Towne Manufacturing Company, of Stamford, Conn., and is operated by a small one horse-power Crocker-Wheeler motor perched on top of it directly under the projecting roof of the car. The contrast between the size of the motor and the bulk it operates is very striking. The total outfit as at present constructed weighs 30 tons, but another car is now being built which will be lighter to handle, and by which the work can be done more rapidly. The Johnson Company have a contract to weld 16 miles of track for the West End as a practical test of the system, and if the results are satisfactory the work will be continued over the entire line.

W. M. Brown, of the Johnson Company, who is in charge of the work, estimates that it will take them three months to carry out the present contract.

ELECTRIC RAILWAY—ACCIDENT—NEGLIGENCE.

THE Supreme Court of Georgia held, in the recent case of the Augusta Railway Company vs. Glover, that although there may be no negligence whatever in the failure of an electric street railway company to have gates to the platforms of its cars, for the purpose of guarding against accidents to passengers by preventing them from leaving the cars on the side next to a parallel track of the same company in the street, yet when a particular company has such gates to the platforms of its cars, not to keep them closed may or may not be negligence in the given instance, the question being one of fact for the jury, and that an electric railway which has provided its cars with gates to prevent passengers from alighting on the side next to a parallel track could not defend itself against the charge of negligence in not keeping one of the gates closed, by the evidence of its president "as to observations he had made in reference to electric street-car lines, cable-car lines and other street-car lines operating on double tracks, that he had made recently in various cities of the United States in reference to the use of gates on the cars, and to show that gates are not used."

John Stephenson, who built the first street car in America, and who subsequently became the head of the most extensive manufactory in this line in the United States, died in New York last month, aged 84 years.

In the action of Rev. R. Hobbs against the Niagara Falls Tramway Company, in which the plaintiff sought to restrain the company from operating their line on Sunday, the High Court of Justice has decided in favor of the defendants.

THE BLACKENING OF LAMP BULBS.

Few subjects have given rise to more speculation than the blackening of the bulbs of incandescent lamps. At one time it was said to be due to platinum thrown off from the leading-in wires. Then it was due to something mysteriously called "air washing." Some people are fond of working mystery into explanations of anything where electricity or high vacua are concerned, so that when they exist together there is a double tendency towards the mysterious. Recently mercury vapor has been said to be the cause of the blackening, but this theory seems to have been developed more especially by American inventors of mechanical pumps which do not use mercury. There is still another theory, due, we believe, to Sawyer, according to which there is some oxygen in the bulb, which combines with the carbon at the very high temperature produced, then deposits the carbon on the glass and goes off to the filament again for more, and so on. It does not matter at all with this theory that there is no known oxide of carbon which decomposes automatically at a low temperature. In a vacuum and in an electric lamp the laws of chemistry ought, it would seem, to be quite different from the humdrum laws of Nature under pressure with no electric current about. It is possible that hot carbon slowly volatilizes considerably below its melting point, just as camphor does. This theory would be too simple, however. It would be safer to assume that the difference of potential between the legs the filament causes currents across the air space—hot rarefied gases being good conductors—and that these cause the carbon to leave the filaments and to be deposited on the glass. The whole subject requires to be investigated carefully, and would probably well repay any time and trouble expended upon its elucidation.—*London Industries.*

PUBLICATIONS.

We welcome the first number of the *Engineering Review* published in London, Eng., and edited by Mr. J. Stephen Jeans, late Secretary of the Iron and Steel Institute of Great Britain. The new journal aims to fill a position in the engineering field similar to that occupied in the field of literature by the *Review of Reviews*. Mr. Jeans is apparently well qualified to make a success of the venture, and we trust that he may succeed in doing so.

SPARKS.

Mr. R. L. Borden has been appointed by the Supreme Court, trustee of the Halifax Illuminating and Motor Company.

An overhead bridge 40 feet wide, is to be constructed at Mile End, by the Montreal Park and Island Railway Company.

The Welland Power and Supply Canal Company, of St. Catharines, Ont., are applying for incorporation with a capital stock of $500,000.

The electric light plant which served to light the streets and business premises of St. Mary's, Ont., was partially destroyed by fire on the 8th of August.

The City Attorney of Montreal gives it as his opinion that the Montreal Street Railway Company have no exclusive running privileges over the streets of that city.

A resolution was recently passed by the Board of Trade, Ottawa, recommending that a bill for the inspection and measurement of electricity be brought before Parliament.

The Chambers Electric Light and Power Company of Truro, N. S., have offered to erect and operate 40 arc lamps and a fire alarm service in that City for the sum of $3,000 per year.

The Montreal Street Railway Company has been granted a 30 years franchise by the council of Coteau St. Louis. The Company expect to have cars running to Amherst Park within a month.

The C. P. R. are about to construct a new telegraph line 300 miles in extent, to connect Halifax with Sydney, C. B. It is proposed to lay one cable across the Strait of Canso and one at the Grand Narrows.

A Detroit syndicate is endeavouring to secure a charter for an electric railway from Walkerville to Tecumseh, a distance of 13 miles. The company offer to give a bond as a guarantee of the early completion of the undertaking.

The Automatic Telephone and Electric Company of Canada are said to contemplate a no less extensive undertaking than that of constructing a metallic telephone circuit from Halifax to Vancouver, a distance of 3,500 miles.

Mr. R. Lynch has retired from the firm of Nie & Lynch, engine and boiler manufacturers, Hamilton, Ont. The business will be carried on under the management of the remaining partners under the name of Nie & Witfield.

The Town Council of Edmonton, N. W. T., recently resolved to seek legislation for the establishment of an electric railway system in Edmonton and the vicinity and to provide for its operation either by the municipality or by a company.

The receipts of the Montreal Street Railway Company for July last exceeded those of the previous year by $9,000. The number of miles travelled by the cars in July, 1893, was 282,696, as compared with 93,601 in 1892. The Royal Electric Company are to furnish the Street Railway Company with 500 additional horse power

Mr. Bert C. Lee, of Pittsburgh, Pa., has been appointed electrical engineer of the Ottawa Street Railway Company. Mr. Lee is a native of China, but has resided for some twenty years in America, and has travelled extensively in Europe and the United States in the interests of the Westinghouse Company, of Pittsburgh. He is said to be a most competent engineer and electrician.

MOONLIGHTS SCHEDULE FOR SEPTEMBER.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1.....	P. M. 7.00	P. M. 10.20	3.20
2.....	" 7.00	" 11 00	4.00
3.....	" 7.00	" 11.50	4.50
4.....	" 7 00	A.M. 12.50	5.50
5.....	" 6.50	" 1.00	6.10
6.....	" 6.50	" 2.00	7.10
7.....	" 6.50	" 3.20	8.30
8.....	" 6.50	" 4.30	9.40
9.....	" 6.50	" 4.40	9.50
10.....	" 6.50	" 4.40	9.50
11.....	" 6.50	" 4.40	9.50
12.....	" 6.40	" 4.40	10 00
13.....	" 6.40	" 4.40	10.00
14.....	" 7.10	" 4.40	9.30
15.....	" 7.40	" 4.40	9.00
16.....	" 8.20	" 4.40	8.20
17.....	" 9.00	" 4.40	7.40
18.....	" 10.00	" 4.40	6.40
19.....	" 10.50	" 4.40	5.50
20.....	" 11.50	.....	4.50
21.....	.....	" 4.40	
22.....	A.M. 1.00	" 4.40	3.40
23.....	" 2.20	" 4.50	2.40
24.....	" 3.20	" 4.50	1.30
25.....	No light.	No light.	
26.....	No light.	No light.	
27.....	No light.	No light.	
28.....	P. M. 6.20	P. M. 8.20	2.00
29.....	" 6.20	" 9.00	2.40
30.....	" 6.10	" 9.40	3.30
		Total,	166.50

The Third Convention of the Canadian Electrical Association at Toronto, on the 12th, 13th and 14th, promises to be the best that has yet been held. Will you participate in the pleasure and profit of the occasion?

CARBONS

Some Particulars of the Process of Manufacture.

CARBON is an elementary substance, occurring in nature uncombined, as the diamond and mineral plumbago. It is much more abundant, however, in a state of combination; thus it occurs in union with oxygen in the carbonic acid present in the atmosphere, and in combination with oxygen and calcium, forms in the shape of limestone a large portion of the earth's crust. In union mainly with hydrogen, it is the chief constituent of coal and mineral oils, and along with oxygen, hydrogen and nitrogen, is an abundant ingredient of animals and still more so of plants. It exists in several altropic forms, that is, forms which differ from each other in many physical and some chemical properties, but which nevertheless consist of nothing but single element.

Wood carbon, or charcoal, is prepared by heating wood in iron retorts as long as it evolves anything volatile. When coal is treated in the same manner as it is in the manufacture of coal gas, the excess of carbon is in like manner left behind, forming a hard shining light solid, valued as an economical and powerful fuel. This substance, which is literally charred-coal, and therefore best deserves the title of charcoal, goes nevertheless by the name of coke. A variety of this material is found in the upper parts of the gas retorts, and is probably formed by the decomposition of gaseous compounds of carbon and hydrogen. It is very hard and porous with almost a metallic lustre, and is a good conductor of heat and electricity, but this is of little value, if any, in the carbon business. However, 25 per cent. of this coke mixed with 75 per cent. of petroleum coke, is said to make a good carbon for low tension work. Another variety of this material is obtained from the oil regions, commonly known as petroleum coke. This is a by-product of the oil stills, and is the only kind used to any great extent in the manufacture of carbon points for the electrical industry. It is of primary importance that the coke, and in fact all the ingredients used, be absolutely free from impurities. Sulphur, iron and dirt—such as shale, sand and other foreign matter which by careless handling may get in—are the impurities frequently met with, but sulphur is by far the worst the carbon maker has to contend with; but by using the very best of coke which is obtained from Pennsylvania oils, trouble from this source is reduced to a minimum. The other constituent of our carbon is pitch This is made from coal tar which is a by-product of the gas retorts. It may also be obtained from blast furnaces, but this kind is more or less contaminated with iron, and therefore is unfit for this class of work. Pitch for this particular purpose is difficult to obtain, as the makers do not care to expose their still to the high temperature necessary to drive out all of the oil, and reduce it to the proper specific gravity.

The first step in the process of manufacture is that of crushing the coke. This is accomplished by means of a machine somewhat in appearance like a mammoth coffee mill. The coke comes from this crushed to about the size of coarse gravel, it is then automatically elevated to a large bin in the upper part of the factory, and from there it is conveyed to a large iron hopper situated directly over the calcining retorts. Into these the granulated coke is conducted by means of spouts with gates arranged to control the flow of material into the several aforementioned retorts. They are then sealed up, thereby preventing combustion, with the exception of a few vents to allow of the escape of gas, arising from the heating of the coke to a state of incandescence, which point is reached in from twenty-four to forty-eight hours after firing. After this if the coke is not pure it will be found to have caked, necessitating in some cases the use of bars to break it up sufficiently to allow of it being drawn from the retorts. If pure it will appear crisp and dry and to have suffered a loss in weight of about 30 per cent. After retorts have been drawn sufficiently long to allow of cooling, their contents are elevated to the milling department and run through a set of French burr stones incased in iron, very similar to the grist mill chop stones; then through a silk bolter separating the coarse from the fine, the former returning to the milling machine, the latter being conveyed to bins with suitably arranged spouts over scales from which it may be drawn and weighed as required by mixing department. The other ingredient namely, pitch, is a dense, hard solid very brittle and dry, and in appearance somewhat resembling gutta-percha. This material, when it reaches the factory, is incased in casks, holding about 600 lbs. each It is then broken up by the men into a convenient size for handling, and subject-

ed to a granulating process similar to that of the coke; finally we find it at a close spout beside the one from which the coke can be drawn. Upon the manipulation of the materials at this stage the success of the future carbon greatly depends, in fact the great secret lies in the mixing. We can better understand the skill and care required to properly amalgamate the mixture when we learn that each particle or grain of coke must have its individual coating of pitch, and it may be interesting to learn that this coke is ground so fine that a grain magnified a thousand times would only appear the size of a shot. To obtain these results the materials are carefully proportioned by weight and placed in a mixing barrel. This is a rotating cast iron cylinder within which revolves, in the same direction and twice as fast as the cylinder, an independent shaft, to which are attached arms so arranged that every part of the barrel is covered or swept in each revolution. This is attached to a furnace in such a way that the flues follow the whole circumference of this barrel, maintaining a uniform temperature of 300° F. which is necessary to bring the pitch to a state sufficiently plastic for amalgamation, thirty minutes is the time required for each batch, which would make about 1,600 carbons. From this machine it is taken to the cooling room and spread out for ten or twelve hours to cool. Here the mixture solidifies to such an extent that it becomes necessary to pulverize it again, to perfect it for the moulds. This end is attained by means of a mill, the pulverizing feature of which is two discs thirty inches in diameter, with corrugated face plates revolving in opposite directions at the rate of fifteen hundred revolutions per minute (about one one-hundredth of an inch apart). From this it is once more passed through a bolting machine, and then finding its way down gravity tubes to a bin on the floor below (which is the moulding room) it is carefully weighed out by the workmen on peculiar little scales with clock like dials, in quantities just sufficient to fill each mould as it comes hot from the oven. It having been previously lubricated with some heavy oil, is now ready for its charge, which the operator places in it and works evenly over the whole surface with a spatula, to insure uniformity of density. The cover or top half is placed in position and the mould and its contents passes for a few moments into an oven, the temperature of which is about 300° F. As soon as the mixture has become quite adhesive the mould is placed in the hydraulic press, and subjected to a pressure of several hundred tons. The mould is now removed and opened, and we have a corrugated card containing sixteen or eighteen carbons, each one being joined to its neighbor by a fin which is inevitably formed when subjected to the enormous pressure before mentioned. These cards are placed on plates which are fitted to receive them perfectly. These plates with their contents are piled up and weights placed thereon to prevent warping. When cool they are broken apart, gauged for size, culled, and the fin scraped off. They are then laid in the furnace for baking. This furnace is rectangular in shape, 34x11, four feet deep and made of fire brick, and is similar to a large vat set about two-thirds below the surface of the earth Over this when filled is placed a dome shaped cover, sufficiently high above the sand and tile which covers the carbon to allow of a free passage of the flames, and which is continued by flues back through the sides and also underneath, thus completely enveloping the body of the furnace The carbons are carefully placed in the furnace and separated from each other with washed sand. Some days are required to completely load a furnace, as each section will hold about seventy-five thousand carbons. The cover having been placed in position and sealed with fire clay, the fire is now started crude oil being the fuel used as well as in the case of the retorts and moulders' oven. If the resistance of the samples shows that the contents of the furnace have been sufficiently baked, it is unloaded, the hot carbons being handled with forks. When cold they are sorted, the first and seconds being easily determined by rolling on level steel plates. After this inspection they are ready for the plating room, where they receive their copper coat by being hung in leaden vats containing a saturated solution of sulphate of copper. These vats, of which there are several dozen, are connected in series with a twenty ampere constant current dynamo. Twenty minutes to half an hour is the time required to complete this plating process. They are then washed in hot and cold water and placed on racks to dry, after which they go to the packing department to be rolled in paper and boxed for shipment.

SPARKS.

The new electric street railway at Peterboro' is now in successful operation.

The new electric street railway at Kingston is almost ready to be put in operation.

There is on foot at Chatham a movement to organize a local incandescent electric light company.

The subject of a suitable fender for trolley cars is engaging the attention of the Hamilton city council.

It is said to be the intention of the Hamilton Street Railway Company to extend their line next year to Hamilton Beach

The Bell Telephone Company will spend the sum of $3,000 in replacing crooked poles and painting their poles in London.

Mr. A. W. Congdon has been appointed to succeed Mr. C. F. Medbury as agent for the General Electric Company at Montreal.

The Lake Girard mica mines works at Ottawa have been closed down for two months for the purpose of placing in position new machinery.

The Nanaimo Electric Light Company will hereafter render accounts to customers monthly, and promptly cut off the supply in the case of users in arrears.

The Sandwich, Windsor and Amherstburgh Electric Railroad Company are seeking from the Council the privilege of extending their road to the Canadian Pacific Railway.

The C. P. R. have commenced the construction of a telegraph line along the Soo Railway, thus giving the company an alternative line between the south-east and the west.

The telephone line between Kalso and Nelson, B. C., has been purchased by the C. P. R., who will operate it in connection with their telegraph line to New Denver now under construction.

The Toronto Street Railway Company is looking for a suitable site on which to erect a foundry, the intention being to manufacture everything required in the way of appliances for the road.

The City Council of Fredericton, N. B., has accepted the tender of the Brush-Swan Company to light the city with 50 arc lights of 12,000 c. p., at a cost of $2,000. The plant will be installed at once.

The Montreal Street Railway Company has been given an exclusive thirty years' franchise, for the construction and operation of an electric street railway in the town of Cote St. Antoine, and also exemption from taxes for the same period.

The court has dismissed the motion brought at the instance of Mr. John Kay to quash the by-law of the Township of Etobicoke granting a bonus of $10,000 to the Toronto and Mimico Electric Railway. The bonus will accordingly accrue to the railway and insure the completion of the enterprise.

The employees of T. W. Ness & Co. and a large number of their friends held their first annual picnic at St. Rose, on Aug. 24th, which was largely attended. An attractive programme had been arranged by the committee, which included races and athletic sports as well as a base-ball match between the Electrics and Clippers, which resulted in the defeat of the latter by a score of 11 to 9. The picnic was a most successful one, and was thoroughly enjoyed by all present.

SPARKS.

The Pontiac Telephone Company propose to extend their system to Pembroke, and will put in 60 telephones between Guyon and Fort Coulonge.

Incandescent lighting plants will be installed at Simcoe, Ont., by the present local lighting company and also by the Reliance Electric Mfg. Company, of Waterford.

Col. James N. Clark, of Windsor, Ont., was in London recently looking over the possibilities for obtaining an electric street railway franchise, and submitted an offer which the Council is considering.

The eastern members of the Electrical Congress held at Chicago, enjoyed a ride over the Niagara Falls Park and River Railway on the 20th of August, by invitation of Mr. A. W. Grant, the manager.

The employees of the Royal Electric Company, of Montreal, held their fourth annual picnic at Otterburn Park a few days ago. A lengthy programme of sports was carried out, Messrs. Hager, Henshaw, Hunt and Starr acting as judges. The day was one of much enjoyment.

The city of Windsor has granted the Sandwich, Windsor and Amherstburg Electric Railway Co. a 20 years' franchise, the company agreeing to pay $500 per year for the first ten years and $1,000 per year for the balance of the term. Mr. W. J. Pulling is the Secretary of the company.

The Chaudiere Electric Light Company, of Ottawa, have decided to proceed at once with the erection of their new power station. After receiving tenders for the necessary plant, the company decided to put the machinery in themselves. The station will be equipped with a 1,200 h. p. plant, and provision made for future extensions. The building and plant will cost about $20,000. As a safeguard against flying sparks setting fire to the lumber piles in the neighborhood, it is proposed to erect a chimney 120 feet high.

It is proposed to extend the Brantford Street Railway to Echo Place, and possibly to Bow Park.

A person giving the name of Geo. F. West, and hailing from Toronto, was recently summoned before the court at Milton, Ont., for selling "Bottled Electricity" for the cure of a variety of diseases. West was discharged with a caution.

The water required for the steam plant of the Consolidated Electric Co., of St. John, N. B., has to be brought from the harbor, a distance of 500 feet. The great rise and fall of the tide makes this a somewhat difficult matter. A pumping station was built on the end of the wharf at the foot of Union street. In this was placed a geared duplex power pump manufactured by the Northey Manufacturing Company, of Toronto, weighing about six tons and with a capacity of 1,500 gallons a minute. The large pump has to raise the water by suction and then force it to the station. At low water the lift is great while at high tide it is light. The pump is operated by a 30-h. p. dynamo stationed with the power station machinery. The condenser is what is known as a surface condenser, and is similar in design to those used on ocean steamers, but much larger.

Please mention the ELECTRICAL NEWS when corresponding with advertisers.