The Meeting of the National Electric Light Association.

The sixth meeting of the above association was held in Boston, Mass., on August 9, 10, and 11. It was pronounced the most important meeting yet held, as it was the most numerously attended.

The president was Mr. J. Frank Morrison, of Baltimore, Md., who called the meeting to order at 10:30 A. M. of the first day. The place of meeting was the Parker House. In a brief address he reviewed some features of the progress of the last six months, and alluded to some of the promised papers to be read before the meeting. At the conclusion of his remarks he introduced Mayor O'Brien, of Boston. In brief but very felicitous remarks he welcomed them to the city. He noted the field for work they could find there in running street cars or small motors. Boston, he stated, had neglected small industries, and in electricity might be found the means of building them up.

The first business done was the presentation of the report of the legal committee on patent legislation. The report was presented by Mr. Arthur Steuart, of Baltimore. Its general tenor was in the direction of suggesting more thorough work by the Patent Office, so that the verdict of the office in granting a patent might be accepted as in some sense a guarantee of its legal force, so as to diminish litigation. The needs of the office in the way of a laboratory and of apparatus were also spoken of. The tenure of office, particularly of the commissioner, was declared unsatisfactory. While taking these and other somewhat radical views, a resolution was presented. The members were exhorted to use their influence with Congress to have it passed at the next session. This resolution provides for the appointment by Congress of a commission of three members, at an annual salary of $5,000, to study the requirements of the patent law, and to report thereon to Congress. The commission is to present to that body a draught of an act embodying what they shall decide to be desirable changes. Of this proposed action we shall speak elsewhere more at length. This report was followed by the report of the legal bureau, also presented by Mr. Steuart, its custodian. He announced that in the near future he hoped to be able to offer to the members the use of an analytical digest of patents and of the literature of electric lighting. The object of the proposed digest is to enable members to form some estimate of the scope and validity of new patents. Thirty-three serial publications were mentioned as drawn upon for this purpose. Mr. A. J. De Camp, of Philadelphia, presented the report of the committee on revision of the constitution. After discussion, the report was recommitted for the present. The report of the Committee on Wire Gauge was presented by Mr. A. V. Garratt. The difficulties of the subject were recapitulated both in the report and in the discussion which followed. A large table, entitled "Mathematical Properties of the Metric Wire Gauge," was presented in connection with it. This really valuable piece of work represents an immense amount of labor, embracing wire of diameter from 0·1 millimeter up to 10 millimeters, advancing by single tenths; in B. & S. gauge from No. 38 to 000. Eighteen columns of different factors and equivalents are given, both foot and pound as well as metric references being provided for.

The Committee on Proper Insulation of Wires and Proper Installation and Construction of Plants presented a preliminary report, followed by their resignations, as no funds were available for bringing the work to a conclusion. Mr. M. M. M. Slattery, of Woburn, Mass., then read the report of the Committee on Electrical Distribution by Alternating Currents. This, as our readers know, is one of the last developments in electrical engineering, and in the paper and discussion which followed its reading some very interesting points were brought out. One conclusion that would be considered rather remarkable was that shocks from alternating current were less to be dreaded than those from direct current machines. They tend to throw the person shocked away from them, and the burn is far less severe than that due to a direct current.

Electrical education was treated in a paper read by Mr. E. R. Weeks, of Kansas City, Mo. The Electric Light Outfit of the New Government Cruisers, by Lieut. J. B. Mudoch, U. S. Navy Electrician at the Torpedo Station, Newport, R. I., was a carefully prepared essay, stating the difficulties and conditions of the problem, and appealing to the electric engineers of the country to assist in its solution. Low-speed dynamos, coupled directly to their engine, were advocated. The use of the current for driving motors to actuate the loading machinery, etc., about the guns was recommended also. Several tables of dynamo constants, giving watts produced per pound and per square inch floor space by dynamos of different makers, were embodied in the paper.

Other papers were: On Bending Test of Wire and on Silicon Bronze Wire, by Dr. Leonard Waldo, of Yale College; on The Present Status of the Storage Battery, by Mr. C. O. Mailloux; and on Storage Batteries for Locomotion, by Prof. A. Reckenzaun.

The meeting finally adjourned on Thursday afternoon. Various social gatherings, excursions, and receptions by the Boston Electrical Club and other organizations characterized the progress of the meeting.

ON A MAGNETIC BRIDGE OR BALANCE FOR MEASURING MAGNETIC CONDUCTIVITY.*

BY THOMAS A. EDISON.

Perhaps no electric measuring instrument has proved more useful in practice, especially if we consider the

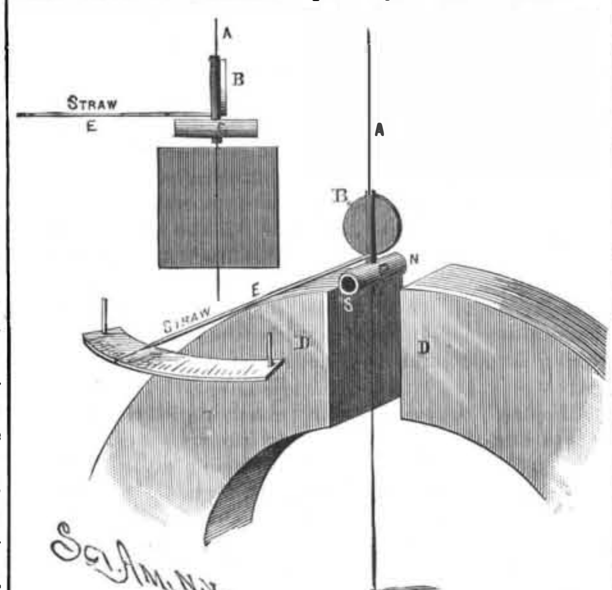

Fig. 2.—EDISON'S MAGNETIC BRIDGE—ENLARGED VIEWS OF MIRROR AND NEEDLE.

various forms which it has assumed, than the device contrived by Christie and commonly known as Wheatstone's bridge. It was with the belief that a similar instrument could be constructed which should perform the same service for magnetic measurements, that the experiments were made the results of which I have the honor now to present to the section.

The Wheatstone bridge is based upon the fact that if two points of different electric potentials are united by two conducting paths, the fall of potential along these paths is absolutely the same, provided that these paths are absolutely alike electrically. Consequently, if two points equidistant from the place of higher potential be connected together, no current will flow through the connecting wire. So, by analogy, if two points be maintained at a constant difference from one to the other through two or more paths the magnetic potential will be absolutely uniform in all, provided these paths be magnetically identical. Hence, at any two points equidistant from a given terminal, the magnetic potential is the same, and these points would be without differential action upon a magnetic pole.

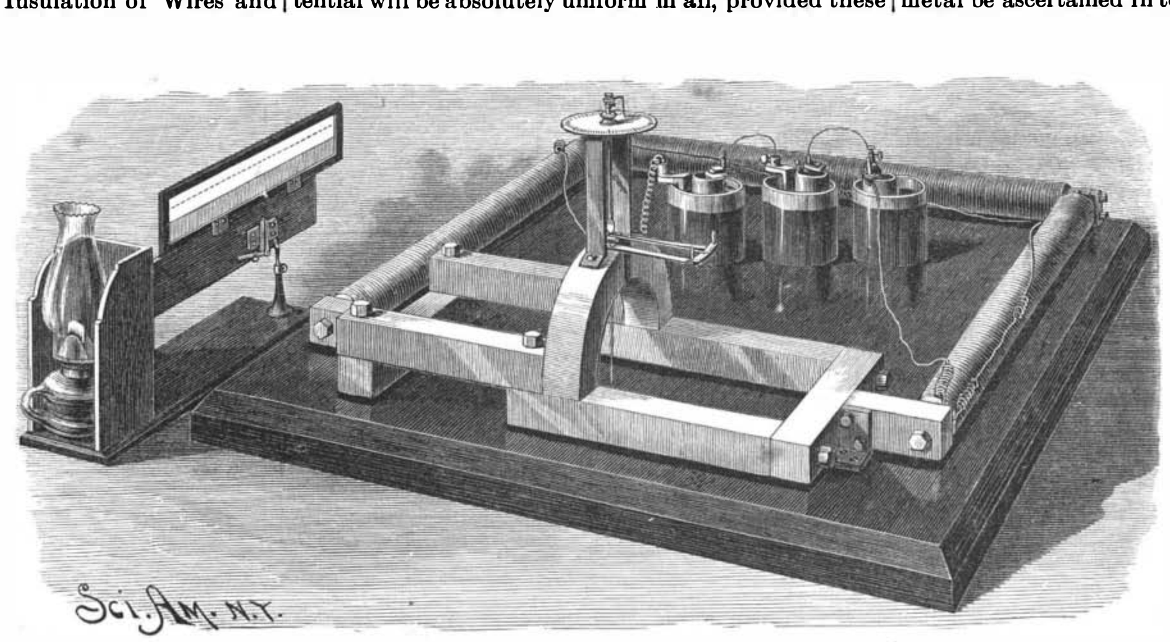

Fig. 1.—EDISON'S MAGNETIC BRIDGE.

The magnetic bridge may be constructed in the form of a rhomb, the typical form of the Wheatstone bridge. For this purpose the four sides are made of the purest Norway iron, as soft as possible, and thoroughly annealed. To the acute angles of the rhomb are connected the poles of a long U-shaped electro-magnet, whose function is to develop the desired magnetic potential difference at these points. Connected to the two obtuse angles, and projecting inward, are two bars of Norway iron similar in section to those forming the sides. Their inner ends, which are hollowed out, approach to within about a half inch of each other. Between these ends a stirrup is suspended by means of a silk fiber, which stirrup carries a short needle consisting of a thin tube of hardened steel well magnetized. To the stirrup is attached either a pointer moving over a graduated arc or, better, a mirror by means of which the deflection can be read in the usual way with a lamp stand and scale.

In the instrument now in use in my laboratory, the magnetic bridge is in the form of a rectangle, the ends or poles of the electro-magnet being connected to the middle of the short sides, while the bars which pass inward to the needle are joined to the middle of the longer sides. The four halves of these longer sides constitute the sides of the bridge. The two at one end of the rectangle are fixed, the two at the other end are movable. The two bars which pass inward to the needle are curved so as to form a semicircle standing above the plane of the rectangle. The needle itself is similar in construction to that above described, but is suspended by a wire attached to a torsion head. A photograph of this apparatus I have the pleasure of exhibiting to the section.

It will be readily seen that when the electro-magnet is charged, a constant difference of magnetic potential is maintained at the two ends of the rectangle, so that if the four bars constituting the sides of the bridge are magnetically identical, there will be no difference of magnetic potential between the ends of the bars which pass to the needle, and hence there will be no deflection; but if one of the movable bars be loosened, the needle is at once deflected, and in a direction depending upon the side the bar occupies. If the bar be entirely removed, the deflection is a maximum of course. And if it be replaced by another bar differing in cross section, in quality of iron, or in any other way which affects the magnetic conductivity through the bridge, the deflection shows at once the amount of difference between that bar and the original one taken as a standard. The instrument is extraordinarily delicate, and the principal difficulties encountered in using it have arisen in the attempt to preserve this delicacy while at the same time the range of the apparatus is maintained.

The magnetic bridge was devised for the purpose of testing readily the quality of the iron purchased for the construction of dynamos. Very great variations are observed in irons supposed commercially to be of the same quality. Consequently, the potential difference developed by a dynamo having field cores of such iron can never be exactly calculated. But by comparing the iron which is to be thus used, in the magnetic bridge, its exact value for dynamo purposes may be determined, and the constants of the generator thus accurately calculated in advance.

But this bridge, it would seem, will be equally useful for testing iron and steel for other purposes. By its means, not only may the character and quality of the metal be ascertained in terms of any desired standard, but flaws in the interior of a bar, such as a car axle, may be discovered at once.

Constructed with sufficient care and attention to details, the magnetic bridge may without doubt be made a most valuable instrument of precision for the furtherance of scientific research. The theory of its action is extremely simple, and it is the exact counterpart of an ordinary Wheatstone bridge constructed for measuring low resistance and immersed in water, since, now, whatever is true electrically of the one is true magnetically of the other. Not only may the laws of magnetic conductivity be investigated by means of this balance for all para and dia magnetic bodies, but the variation of this conductivity under the action of various physical agencies, such as heat, pressure, strain, etc., may be determined. It is in the belief that this instrument may contribute something to the advancement of electrical science, and with the hope that it may do so, that I venture to bring it to the notice of my fellow members of the American Association.

* Abstract of paper read before the American Association for the Advancement of Science, New York, August, 1887.

THEY make a wine of tomatoes in Florida which is said to be superior to orange wine.

Electrical Items.

An Electrical Copying Process.—Mr. Garel has just invented a very simple apparatus for obtaining a certain number of copies of a letter or circular. The inventor writes with an ordinary black pencil upon very thin paper, which rests upon a block of carbon. The plumbago of the pencil communicates with one of the terminals of a small induction coil, and the carbon with the other. The point of the pencil gives a series of sparks, and the paper can be used as a stencil for the reproduction of the writing by passing an ink roller over it.

The Dip of the Magnetic Needle.—Mr. G. A. Rowell, of Oxford, England, has just published a pamphlet on atmospheric electricity and the causes of the changes in the inclination of the magnetic needle. The author attempts to demonstrate that the magnetic poles of Europe and America coincide with the centers of the greatest cold upon the two continents. He attributes the shifting of the magnetic poles to the same series of astronomical and geological phenomena that produce the secular changes in climate. This theory, he adds, leads us to the not very agreeable conclusion that our winters will be prolonged and will increase in severity, since the magnetic inclination keeps on diminishing.

Conversion of Heat into Electricity.—Messrs. Hurghausen and Nerust have recently performed an experiment which is very curious from a scientific point of view. On placing a thin sheet of metal in a magnetic field and keeping its two extremities at unequal temperatures, they remarked that the extremities exhibited a very feeble, yet appreciable, difference of potential. Moreover, the direction of the current varied according to the direction of the lines of force of the magnetic field. The experimenters operated with a plate of bismuth, 5 centimeters square and 2 millimeters in thickness, placed in a field of 5,000 units. The difference in temperature was obtained by placing against the ends of the plate two sheets of mica, one of which dipped into cold water and the other was heated by the flame of a gas burner. Under such circumstances, a difference of potential of 0·00125 volt was obtained.

Welding by Electricity.—The process of welding invented by Mr. De Benardoz, of Russia, is now applied industrially by the Society for the Electrical Working of Metals. The pieces to be welded are placed upon a cast iron plate supported by an insulated table and connected with the negative pole of a source of electricity. The positive pole communicates with an electric carbon inserted in an insulating handle. On drawing the point of the carbon along the edges of the metal to be welded, the operator closes the circuit. He has then merely to raise the point slightly to produce a voltaic arc whose high temperature melts the two pieces of metal and causes them to unite. The intensity of the current naturally varies with the work to be done. For regulating it, a battery of accumulators is used, and the number of the latter is increased or diminished as need be. This process of welding is largely employed in the manufacture of metallic tanks and reservoirs.

Manufacture of Carbons for Arc Lamps.—The manufacture of carbons for arc lamps has become a large industry in the United States. During the course of a recent trial at Cleveland, Ohio, concerning the infringement of a patent, it transpired that there are 150,000 carbons daily used in this country, 100,000 of which are manufactured at Cleveland, where there are twenty furnaces. The carbons are made from the residua of petroleum distillation, as well as from the carbonaceous deposits found around natural gas wells. The materials are finely pulverized, mixed with a little pitch, and placed in moulds, which are packed in boxes and put into a furnace, where they are submitted to an intense heat. The capacity of an ordinary furnace is 45,000 crayons. By means of a movable covering, which forms the original part of the patent that gave rise to the controversy alluded to above, two furnaces are constructed side by side, and one of these is charged while the other is heated. With this system, two men can charge one furnace per day. The crayons are baked for five days, and the cooling takes twenty-four hours.

Telephony in St. Louis.—The subscribers of the telephone line in St. Louis, says an exchange, do not pay a fixed subscription to the company, but merely the sum of five cents for each communication. The collection of this sum is effected automatically by the apparatus itself. Above the transmitter there is a box containing a slit in the upper part. When the subscriber wishes to communicate with any one, he places a five cent piece in the slit and takes the receiver from its hook. The coin, in sliding, closes a circuit, a call is made at the central office, and the subscriber can talk as long as he pleases, either with the office or another subscriber. When the conversation is finished, he has only to hang up the receiver in order to give an automatic signal to break the communication, and the coin falls into a box whose key is carried by the company's collector.

If the person with whom the subscriber wishes to speak is already in communication, the employe of the central office informs him of the fact by means of a contact upon which he presses, and which sets a mechanism in operation that drives the coin to the side of the box; and when the subscriber hangs up his receiver, the money is returned to him. More than two hundred of these apparatus are now in operation in St. Louis, and are giving very good results.

Dissipating the Smoke of Cannons.—The discovery, by Mr. Lodge, of the curious effect of discharges of static electricity upon dust and vapor has been utilized by Mr. J. G. Lorrain in the construction of an apparatus for the dissipation of the smoke derived from the discharge of ordnance of every kind.

Mr. Lorrain proposes to employ an electrostatic generator in communication with appropriate conductors arranged around the mouth of the gun. As a conductor, he prefers a light wire lattice provided with points that permit of obtaining silent discharges in the air. The generator that he proposes is Wimshurst's, this being less affected by dampness than most others. It may be placed anywhere, and be actuated by any kind of motive power desired.

Notable Chemical Exhibits.

One of the most interesting exhibits in the chemical section of the London exhibition is that of Dr. Theodor Schuchardt, of Gorlitz, in Germany, consisting of an excellent collection of rare and new chemical preparations, especially those used in scientific, medical, pharmaceutical, photographic, and technical work.

A large amount of time and labor must have been expended in order to bring before the public this proof of the great progress chemistry is making in her ever extending relations with the different branches of natural history. We here see 67 inorganic and 190 organic compounds which have never before been produced in such quantity, and at the same time in such a state of purity.

The first section consists principally of the rare elements and those compounds of other elements which may justly be called rare, considering the difficulties to be overcome in their manufacture. First among these we notice selenium and tellurium, both similar to sulphur in their chemical reactions, and found in very few minerals. The pure selenium is shown in very good hexagonal crystals, and the tellurium in the form of brilliant needles of metallic luster. "Germanium," one of the newest elements discovered by Professor Winkler, is also shown. Up to the present time it has only been found in one mineral, and that a rare one, named "argyrodite," found at Freiberg. Its chemical reactions are of great interest, its salts being of a very soluble character.

Among the other metalloids exhibited by this firm we may mention a box containing large crystals of silicium and brilliant leaf-shaped crystals of zirconium. Oxide of zirconium is at present attracting some attention with regard to its magnificent incandescent properties when used in the Welsbach lamp, and it is not improbable that its preparation may before long develop into an industry of some importance. Among the metals exhibited we note two tubes containing potassium and sodium melted in presence of hydrogen, thus preserving their true metallic luster.

There are also to be seen the newly described cubes of chloride of lime mixed with gypsum, which render it possible to obtain an easily regulated current of pure chlorine gas. Salts of cerium, yttrium, erbium, as well as the metals indium and gallium in spectroscopic purity, are also shown. The last two metals would in all probability never have been discovered except for the spectroscope, as they occur in such minute proportions; the zinc ore near Freiberg, in which indium was discovered, contains only 0·1 per cent of that metal, while gallium, which may be called one of the rarest metals, is found in "black jack" in no larger quantity than 0·001 per cent. Its production in quantity is therefore a matter of extreme delicacy, requiring great care, but it has been successfully carried out by a new method discovered in Dr. Schuchardt's laboratory. Gallium is here shown both in solid and liquid forms, and it is the first time that crystals of this metal have been publicly exhibited.

Another interesting body is osmic acid, shown in the form of brilliant fern-like crystals. It has long been used in physiological studies as a means of distinguishing between nerves and veins. The second section, consisting of organic compounds, contains all the most recently discovered and interesting bodies in this branch of chemical science. We first mention "thiophen," a new organic sulphur compound, which is now being manufactured in considerable quantity by this firm. Formerly obtained in the distillation of coal tar, it is now produced from succinate of sodium and phosphide of sulphur.

Following the catalogue, attention will be drawn to the compounds of croconic acid. There are also its intermediate products, such as diactyl-hydrochinon, etc. Of greater interest may be naphthyl-phenyl-keton-dibromide, which is of great service to mineralogists in optical work, on account of its great refractive power; a similar value is attached to the heavy iodide of methylen, used for determining the specific gravity of precious stones, etc.

Of the numerous alkaloids exhibited, "wrightin" takes the first place. It is the only alkaloid free from oxygen. It is found in plants, and when in a state of great purity, as in the present instance, it takes the form of long white needles. Other alkaloids here exhibited are hydrastin, from *Hydrastis canadensis*, possessed of great crystallizing powers; scapolin, from *Scapolia saponica*, which is of an extremely poisonous nature, even when diluted to 1 in 5,000; and many more. Among other interesting specimens we find a collection of vegetable dyes, chlorophyl, chlorophyllan, phyllopurpurin, orcein, and the interesting group of nitrogen compounds.

We cannot conclude without mentioning two new test papers invented by Charles Wurster; one saturated with dimethyl-para-phenylendiamin enables us to detect the presence and quantity of wood fiber in any paper, while the other, saturated with terta-methyl-para-phenylendiamin, will detect the smallest quantity of active oxygen. The property of the latter paper is of great importance, as by its means the hygienic value of the air at any place can be readily ascertained.—*Chem. News.*

Colors for Polished Brass.

Mr. E. Ebermeyer has just published in the *Zeitschrift fur der Chemie Indust.* formulas for a number of baths, designed to give polished brass various colors.

The brass objects are put into boiling solutions composed of different salts, and the intensity of the shade obtained is dependent upon the duration of the immersion.

With a solution composed of:

Sulphate of copper	120 grains.
Hydrochlorate of ammonia	30 "
Water	1 quart.

greenish shades are obtained. With the following solution, all the shades of brown from orange brown to cinnamon are obtained:

Chlorate of potash	150 grains.
Sulphate of copper	150 "
Water	1 quart.

The following solution gives the brass first a rosy tint and then colors it violet and blue:

Sulphate of copper	435 grains.
Hyposulphite of soda	300 "
Cream of tartar	150 "
Water	1 pint.

Upon adding to the last solution:

Ammoniacal sulph. of iron	300 grains.
Hyposulphite of soda	300 "

there are obtained, according to the duration of the immersion, yellowish, orange, rosy, then bluish shades. Upon polarizing the ebullition, the blue tint gives way to yellow, and finally to a pretty gray. Silver, under the same circumstances, becomes very beautifully colored.

After a long ebullition in the following solution, we obtain a yellow brown shade, and then a remarkable fire red:

Chlorate of potash	75 grains.
Carbonate of nickel	30 "
Salt of nickel	75 "
Water	10 ounces.

The following solution gives a beautiful dark brown color:

Chlorate of potash	75 grains.
Salt of nickel	150 "
Water	10 ounces.

The following gives, in the first place, a red, which passes to blue, then to pale lilac, and finally to white:

Orpiment	75 grains.
Crystallized sal sodæ	150 "
Water	10 ounces.

The following gives a yellow brown:

Salt of nickel	75 grains.
Sulphate of copper	75 "
Chlorate of potash	75 "
Water	10 ounces.

On mixing the following solutions, sulphur separates and the brass becomes covered with iridescent crystallizations:

I.

Cream of tartar	75 grains.
Sulphate of copper	75 "
Water	10 ounces.

II.

Hyposulphite of soda	225 grains.
Water	5 ounces.

Upon leaving the brass objects immersed in the following mixture, contained in corked vessels, they at length acquire a very beautiful blue color:

Hepar of sulphur	15 grains.
Ammonia	75 "
Water	4 ounces.

THE locomotive industrial works of the United States have been very busy lately, in the production of new motors for the increasing traffic of our own and foreign roads. This is shown very forcibly in the report of the last six months' production of the Baldwin Locomotive Works, Philadelphia. With a labor force of 2,000 men, 318 locomotives, nearly two per day, have been finished. Orders for 150 more are in hand, and it is expected that the output for the year will reach the grand total of 650.