Stray Plants.

An interesting botanical lecture was lately delivered by Prof. Rothrock, in Horticultural Hall, Fairmount Park, Philadelphia, on Stray Plants. The lecturer stated that he did not intend confining himself to those larger plants which we can all see, but would embrace also a brief statement of those minuter forms which we never see by the unaided vision, and whose presence was only generally recognized by the evils which they wrought and by the enormous death rates which they induced.

Twenty years ago or more, Bentham and Hooker, the two most distinguished English botanists, began preparation of their great book, the Genera Plantarum. It was intended to bring together in the natural order of their structural affinity all the flowering genera of the existing flora on the globe. What are genera or, as used in the singular, what is a genus? All the species of pine constitute one genus, all the spruces another, all the firs a third, all the cedars a fourth, and all these are grouped in the order of cone-bearing trees. Modern science teaches that all these have descended from a few species of parent plants, and that time and physical surroundings have produced the variations we now see in the vast aggregate of plants representing the order. A study of the Genera Plantarum shows a marked *tendency* in the smaller orders to a localization in a portion of the globe. The larger orders are, as might be expected, more widely spread. The very increase in the number of their genera implies the greater diversity of physical condition which they have encountered in their descent through the ages. Genera are in the main more localized than the orders. This, too, is to be expected. Thus, for example, the genus Crassula, of 120 species, was mainly localized at the Cape of Good Hope. Just in the same way the asters and golden rods found their maximum development in our own region. Sometimes, however, plants would wander off from their birthplaces. Illustrating this, we had the hickory group, of which there are but ten known species. Nine of these grow in the United States and one in Mexico. It is strange that the Mexican species has a four-winged fruit, and stranger still that the Pecan hickory, which, on the whole, is its nearest geographical associate, should also show a marked tendency to the production of fruit of the same kind.

Just, too, as there were in the past vast migrations of men who invaded and took possession of other lands after extirpating the native population, so there had been such migrations among plants. The original forest on the island of Saint Helena had been superseded by European cone-bearing trees. Instances of the same thing on a much larger scale could be named. The strangest examples were where the same species of plant would be found here and in Japan, but nowhere else. Our blue cohosh was such an instance. Hardly less remarkable was it that of the two species of podophyllum (May apple), one grew here and the other in the far-off Himalaya region. We have no reason to doubt that they are blood relatives, but how is it that one or both have strayed from the original birthplace?

It is one of the unexpected things (which Professor Gray has so well shown) that we have more plants here of the Japanese flora than Europe has, and that even the Pacific coast of America has not so many of them as the Atlantic slope has. Europe may have received (by natural means) some few American plants; but, in the main, the line of plant migration has been from the Old World to us—from west to east.

The lecturer then introduced the invisible stray plants, which are only seen clearly by the best powers of the best microscopes, plants that are destitute of the green color which makes our larger and more familiar forms self-sustaining. They (more than the mistletoe) are parasitic. They are the habitual associates of decay, disease, and death; though as yet it would be premature to assert that they are the causes of disease, yet the facts appear to point to that conclusion. Thus we have one supposed to be the cause of diphtheria, another of splenic fever, another of pulmonary tuberculosis, and another of cholera. Take the one last named (comma-shaped), *i. e.*, that of cholera.

First. It is found in persons suffering from cholera.

Second. It is found only in the organs affected by cholera, and, therefore,

Third. It is not found in healthy persons.

Fourth. It diminishes in numbers as the patient convalesces. Hence it is proportionate in number to the gravity of the disease.

Fifth. It has marked powers of locomotion.

Sixth. It lives and multiplies rapidly in the clothing of cholera patients if this be kept damp for twenty-four hours.

Seventh. It will die if kept dry for twenty-four hours.

Eighth. It develops only in substances which have an alkaline reaction.

Ninth. It dies when brought in contact with solutions which contain only a little free acid.

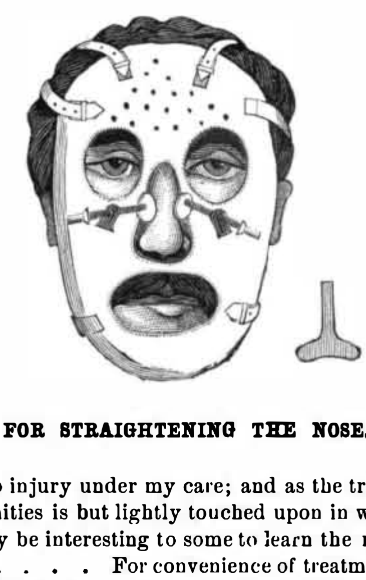
These are substantially the conclusions reached by Koch, who has been the most careful investigator of the subject. Clearly they point to the following cautions in cholera seasons: Cleanliness of the person, of the clothing, and of the surroundings; isolation of cholera patients; destruction by fire of clothing and bedding used by the sufferers; absolute purification and frequent acidulation of drinking water, and the rejection of all water which can in the slightest degree be tainted with sewage from cholera infected districts. All of these conclusions are amply sustained by the experience which epidemics have but too largely furnished. One thing more the importance of this subject teaches. It is, that local, State, and national health boards should be absolutely free from political restraints or from any measure of party expediency; that they should be invested with power which is final; and that they should have the support and active co-operation of every good citizen.

These germs of disease then come fairly under head of Stray Plants. They float in the air we inhale and in the water we drink. And once started in their career of destruction, it is possible for them to incircle the globe with badges of mourning.

TREATMENT OF DEFORMITIES OF THE NOSE.

This is the season of the year when contests at foot ball, base ball, bicycle riding, fox hunting, and kindred outdoor sports are at their height, bringing in their train broken arms, dislocated shoulders, sprained ankles, and not infrequently broken noses. The surgeon's skill is called into requisition more at this time of year than at almost any other, and the cause of this results in casualties of a greater variety than occur to persons in their ordinary pursuits, and hence the doctor and surgeon is sometimes puzzled to determine the best means for treating the peculiar case before him. W. J. Walsham, Assistant Surgeon in charge of the Orthopædic Department at St. Bartholomew's Hospital, London, communicates through the *Lancet* his experience in treating deformities of the nose following injury, which is timely, and will no doubt be found useful to the surgical profession.

"During the last few years," says the distinguished writer, "I have had a considerable number of cases of deformities of



MASK FOR STRAIGHTENING THE NOSE.

the nose due to injury under my care; and as the treatment of such deformities is but lightly touched upon in works on surgery, it may be interesting to some to learn the result of my experience. . . . For convenience of treatment they may be divided into those affecting, first, the lateral cartilages and, second, the nasal bones.

"1. *The Cartilages.*–These may be variously bent or twisted to one or other side, or they may be depressed at the spot where they join the nasal bones, giving the nose in this instance a sunken appearance. In the former case the septum nasi (the central column of support) will as far as I know be always found deflected in a direction opposite to that of the bent lateral cartilage, blocking up more or less completely the correspoding nostril. In the latter case, *i. e.*, when the cartilages are depressed, the septum may not only be deflected, but also, as is unfortunately too often the case, fractured with lateral displacement of the fragments, or else dislocated from the maxillary crest. In addition to the deformity, therefore, there will exist the usual train of symptoms accompanying nasal stenosis from other causes, *i. e.*, a sensation of stuffiness in one or both nostrils, a nasal tone of voice, etc. In neither class of cases will either operative or mechanical treatment alone suffice. The septum must be straightened, and the lateral cartilages at the same time be forced into position, and there retained by mechanical apparatus till the septum has had time to consolidate.

For retaining the septum in position, in my earlier cases, I used Adams' retentive apparatus, modified so as not to injure the columnella. More recently I have had an instrument made of vulcanite, which, however, is open to the objection that the vulcanite is apt to become softened by the heat of the nose, and lose its shape and retaining powers. The advantages of the softer vulcanite may be obtained by having the blades of a steel instrument coated with this material. For solid ivory plugs I have now substituted hollow plugs of vulcanite, which can be worn with greater comfort, as they allow the patient to breathe through them. Many forms of retentive apparatus for holding the lateral cartilages in position were in use before I found one which fulfilled all the indications. At first the ordinary nose truss, which is fastened to the forehead by a band round the head, was tried. This, however, proved of little service, inasmuch as it is liable to shift, and thus give no fixed point to work from. The same objection holds to the spectacle method of fixing the truss. At length this difficulty was overcome by having a mask accurately moulded to the face, as shown in the accompanying wood cut. A plaster of Paris cast is first taken of the face, and in this the leather for the mask is moulded, apertures being left for the mouth, eyes, and nose itself. The mask when thoroughly dry is lined with soft chamois leather, and fits accurately to the irregularities of the face, so that no movement can take place. It is secured by suitably arranged straps around the head. Having thus obtained a fixed point to work from in the mask, it is easy to bring pressure to bear upon the nose in any direction required by means of suitable screws, springs, etc., attached to the mask."

A Telegraphic Contest.

A prize contest for fast telegraphic transmission took place, on August 17, in the Western Union Telegraph Company's building. The prizes were three in number—the first a gold medal, the second a silver medal, and the third a decorated telegraph key. They were given by J. H. Bunnell & Co., of New York, and the only conditions were that the Morse steel lever key should be the one used. The prizes were for "clearness of character and speed combined." The judges of the contest were J. H. Dwight, night force manager; W. B. Waycott, cable manager; and E. F. Howell, chief operator, all of Western Union. The affair was in charge of Mr. F. Catlin, chief operator.

At eleven o'clock, when the contest began, over one hundred leading operators and telegraph managers were present. On a printed slip was the work to be done. This consisted of 500 words, 15 periods, and 4 commas, in all 2,368 characters, as published in the *Operator* of August 15. The messages were sent on a local circuit. There were ten contestants, all of whom did remarkable work, and at one o'clock the contest was finished. Shortly afterward the judges announced their decision, which was as follows: First prize—W. L. Waugh, "superior" work, each letter and character perfect; time, 11 m 27 s. Second prize—W. M. Gibson, "good" work; time, 11 m. 3 s. Third prize—F. J. Kihm, "fair" work; time, 10 m. 32 s. It is notable that not one of the winners is a Western Union man, Waugh belonging to the Commercial Telegram Company Stock Exchange, Gibson to the Bankers and Merchants' Stock Exchange, and Kihm to the United Press Association.

The names of the other contestants, with their time, are as follows: J. W. Roloson, 10 m. 10 s.; L. E. Liddy, 11 m. 58 s.; M. J. Doran, 11 m. 32 s.; W. A. Hennessy, 11 m. 51 s.; E. Delaney, 11 m. 52 s.; Harry Ziegler, 12 m. 29 s.; P. J. Byrne, 13 m. 50 s.

Roloson's time of 10 m. 10 s. is the most remarkable on record, but his work was too indistinct and unreadable to obtain a prize. He is an operator of the Bankers' and Merchants' Company, and with coaching will be a most formidable opponent. The prizes are quite handsome. The gold one is a bar from which hangs a shield-shaped pendant, on which are the name and date of the contest, and in the center the design of a hand holding the lightning. The silver one is a bar to which hangs a round medal, the top of which is cut out, and in its place stands out the same design as the gold one contains.—*Electrical World.*

Great Rafts.

The Cleveland *Press* tells the following: Two of the largest rafts of pine logs ever brought to this port, and the only rafts ever brought from Lake Superior, lie just outside the breakwater. One covers about five and the other eight acres of territory. The largest raft contained about 3,000,000 feet of lumber, and the smallest a little over 2,000,000 feet. There are in both rafts about 16,000 logs, ranging from 12 to 16 feet in length. The rafts left a point on the south shore of Lake Superior, between Grand Marias and Grand Island, about 100 miles west of the Sault, a little more than two weeks ago. They were made up in two sections each, pear-shaped, and inclosed in booms. Through the rivers the sections were towed separately, and they also went through the rapids in the same shape, without loss or damage. The run is about one mile in length, and the fall in the neighborhood of 20 feet. The entire distance from start to destination is about 600 miles. The run from Detour was made in 14 days, the average speed being about 1½ miles an hour.

A Perilous Pathway.

The travels of the native East Indian explorers, their stratagems and their disguises, their hazards and sufferings, their frequent hair-breadth escapes, are teeming with excitement. One of them describes a portion of his track at the back of Mount Everest, as carried for a third of a mile along the face of a precipice at a height of 1,500 feet above the Bhotia-kosi River, upon iron pegs let into the face of the rock, the path being formed by bars of iron and slabs of stone stretching from peg to peg, in no place more than 18 inches, and often not more than 9 inches wide. Nevertheless this path is constantly used by men carrying burdens.

One of the finest feats of mountaineering on record was performed last year by Mr. W. W. Graham, who reached an elevation of 23,500 feet in the Himalayas, about 2,900 feet above the summit of Chimborazo. Mr. Graham was accompanied by an officer of the Swiss army, an experienced mountaineer, and by a professional Swiss guide. They ascended Kabru, a mountain visible from Darjeeling, lying to the west of Kanchinjunga, whose summit still defies the strength of man.

Burnt Umber.

To produce this most important pigment the crude umber is put in iron retorts and subjected to a heat more or less intense. The result is the changing of the tone of the color to a very much deeper and more red brown. The drying property is also increased by burning. Burnt umber, with white and orange chrome yellow, will give a variety of shades of clear warm drabs. Burnt umber, with white and lemon chrome yellow and scarlet lake, will give a rich shade of tan color,

The International Electrical Exposition, Philadelphia.

(SIXTH PAPER.)

More than usual interest and an increased attendance has marked the closing days of the Exposition. The recent experience has shown the managers that three weeks, at least, is required to get a great collection of electrical apparatus into smooth running order. Aside from the usual dilatoriness of exhibitors in general, many of whom do not make up their minds about coming until they learn of the intentions of their rivals, there is the delay attendant upon setting up and experimenting with complicated machinery. Taken as a whole, the Exposition may be said to have been fairly successful, if not from a financial, at least from a scientific standpoint, which is the more gratifying.

It was, of course, a disappointment to discover, when all the exhibits were in, that the Exposition was international in little else but the name. This was not the fault of the Institute under the auspices of which the Exposition was given. It was within its power to invite, but not to enforce attendance. But it was within the power of the managing committee to arrange for the official testing of apparatus at an early day. This they neglected to do, or at least they were dilatory, so dilatory that a week will have passed after the closing of the doors ere the testing of a large and very important class of apparatus can even be begun. This department is under the direction of Prof. M. B. Snyder, a competent man, and it is not his fault that the work of testing is so far behindhand. He could not begin until he had been furnished with the means of testing and the apparatus to be tested, and the amiable but somewhat slow moving theorists who compose the management, forgetting that art is long and time fleeting, when asked to bestir themselves would seem to have adopted the stereotyped reply of the Mexican: *Si, mañana* (Yes, to-morrow).

The plan of doing away with the custom of awarding prizes, and the adoption of the system in vogue at the Vienna Electrical Exposition of giving certificates of official tests made by uninterested persons, promised so well that it was commended even by the exhibitors themselves. Notwithstanding this, the somewhat extraordinary spectacle is presented in the gallery of a company interested in a secondary battery in the act of officially testing their own apparatus. There is no reason to doubt that a reputable company, as this is, may be relied upon to fairly test their own apparatus, but such a proceeding must be regarded as irregular and objectionable, even if nominally supervised by a member of the committee of the Exposition; and if the committee really propose to attach their official signatures to the record of these tests when completed, the act may not unreasonably be looked upon as wholly inconsistent with the theory advanced and promulgated by themselves, to the effect that no person in any way pecuniarily interested in an apparatus should have a hand in testing it. If these people get an official certificate of their own results while testing their secondary battery, surely no other exhibitor should be compelled to submit to the hardship of accepting tests made by strange even if uninterested hands. And should such a course be adopted, the official certificates which each exhibitor would carefully tuck into his innermost pocket upon leaving would, in reality, be as valueless as any other description of tests made out by an interested person, except so far as it might possess the power to deceive the ignorant or impose on the unwary.

Such tests as are made by uninterested persons—and the public cares little for the others—will not be given to either the scientific or the popular press; it having been decided to keep them for a monthly publication of a certain institute. This will, of course, still further retard their appearance, if it does not succeed in keeping them wholly out of the view of the public for which they are intended. It is an unusual course to pursue regarding the results of a great public exposition, and furnishes still further proof, if proof were wanting, that such enterprises in behalf of the inventor and the manufacturer should never be tied to the apron-strings of any particular society or corporation.

There is a general feeling of regret that the Exposition must needs close on the appointed day, as the interest which it has awakened afar and anear is largely in excess of what was expected, and the attendance, instead of showing a gradual falling off, is on the increase. A canvass of the principal exhibitors, however, shows that they are not prepared to remain longer than was at first proposed. The benefits which come from comparison have perhaps rarely found better illustration than within the halls and galleries of this Exposition. Here we have the various dynamos side by side, the gas-motor working by the steam-motor, gas burning alongside of electric lamps. What makes a fair comparison here possible is the fact that everything is in almost perfect running order. The incandescence lamp need not be compared with an ancient and clogged gas jet, nor a great regenerative gas burner of the improved type to an electric lamp purposely designed to show only a faint glow. A comparison of the incandescence lamps while at their best shows that they differ from each other not as one star differs from another, in magnitude only, but in their color, their shape, and the size of their filaments, and above all, in the life of the lamp itself, or rather of the glow within it. These incandescence lamps, shown as they now are with all their latest improvements as to filament, vacuum, shape, and current-conductors, merit some little attention. The Swan lamp, used by the Brush Company in this country, has a filament consisting of carbonized cotton and parchment. In shape it is a spiral, and its resistance cold is about 40 ohms. A no small advantage possessed by this lamp, besides efficiency, is the small cost at which it can be constructed. The latest filament of the Edison lamp is made of fibers of bamboo cane, cut longitudinally, the fibrillæ left undisturbed and carbonized by heat. It is shown principally with intensities of ten, sixteen, and twenty candle-power. The lamp in electrical resistance varies from seventy-eight to ninety ohms pole, and calls for a current of high tension or E. M. F. in order to bring it to the point of incandescence.

The ten candle power lamp is principally interesting because it was designed to represent the real and not the ideal gas jet in intensity, and succeeds admirably in accomplishing this purpose. It was a cunning mind that thus clearly comprehended what was before everybody and yet nobody saw. There is no deception about it, nor is that said in its favor which may not be realized. When the idea of making the incandescence lamp marketable was first entertained, the current was so divided that each lamp should be of the intensity of the gas jet. Now the ordinary five-foot burner when new and clear is of the power of sixteen candles. It does not, as we know, remain very long in this condition; the aperture becomes more and more clogged, and the flame emitted suffers greater or less diminution, according to the nature of the gas burned in it. Hence few burners give the maximum intensity, and, as a result, the general public is accustomed to a light of less than sixteen candle power. Now the theory of charges made by the projectors of incandescence lighting, is to give the public the same amount of light, similarly diffused, as they have been in the habit of receiving from the gas companies, and at the same price. So far as intensity is concerned, it would matter little whether the incandescence lights represented gas jets in good order, when they were at their best, or when they were burning with greatly diminished flame. The electric meter now in use would readily indicate by its transference of copper electrolytically from one electrode to another just how much light had been used. But it was found that the consumer did not appreciate the difference between an electric light with a constant intensity of sixteen candles and a gas jet intended to give a sixteen candle power light, but, by reason of incomplete combustion and other causes, giving out only about ten on the average. He wanted the same number of burners with the same amount of light, and was willing to pay for electricity what before he had been paying for gas. This being the case, a computation was made of the intensity of the average gas jet, and an incandescence lamp was constructed which should have a similar intensity. Hence the ten candle power incandescence lamp.

The Maxim lamp shown in the Exposition is in some respects altogether dissimilar from its original forms. In the earlier incandescence lamps of the present type, the life was so short, or rather the lamps varied so much in duration of life, that they were fit for little else but laboratory experiments. Nature hates a vacuum, and enough oxygen usually remained, when the lamps were removed from the mercury pump, to insure so much combustion of the carbon loop as to constantly threaten the life of the lamp. By some ingenious experiments, Mr. Maxim discovered that the vapor of gasoline, when made to take the place of the extracted air, would keep the carbon loop in repair by making a deposit upon those parts of the loop which had become disintegrated by combustion. Soon, however, it was discovered that the vapor of gasoline had also its defects, for that, besides making a deposit of carbon upon the loop where it was needed, it made still another in the sides of the glass globe, where it was not. As the Maxim lamp is now constructed, the filament is of carbonized cardboard, which previous to being sealed in the lamp is raised to incandescence in a carbonaceous vapor, such, for instance as a hydrocarbon gas, the result being that a fine layer of carbon is deposited upon the filament. The present type of the Maxim lamp is the result of the labors of Mr. Weston, the electrician. Its electrical resistance when cold is from 40 to 60 ohms.

In the Stanley lamp carbonized hair is used as a filament. It is of twenty candles power, and has a resistance of about 80 ohms cold.

The big electrical clock shown near the main entrance to the hall has played a by no means unimportant part in this Exposition. It controls eighty similar secondary clocks, placed in different parts of the buildings, and has been used generally in most delicate experiments; in all cases—so it is said—having given satisfaction. Being purely electric it has neither springs nor weights, and may fairly be compared with the best astronomical clocks. Among the multitude of secondary clocks which are connected to it by wire, some move once a minute, others once in two seconds, and still others every second. The big clock is connected by wire with a telegraph company outside the building, and, at noon, is put in circuit with the National Observatory at Washington, whence the exact time is transmitted.

The storage batteries at the Exposition have proved of great interest, and very naturally, it might be said, for though most people are familiar with the theory upon which they are constructed, only few there be among the general public in this country who have seen them. In the Old Country it is otherwise. Electrical tricycles are sometimes seen in the highways, and electrical launches occasionally appear in the rivers. Such contrivances have, therefore, ceased to be a novelty.

Two batteries of the Planté type are exhibited by a manufacturing company. One consists of 20 cells, the other of 320. Near by is a rheostat of the Plante pattern connected with the larger of the batteries. By this connection the difference may readily be distinguished between the currents of high and low intensity.

The battery is joined in multiple arc, and requires two cells of low intensity to charge it. Being joined in series, it shows the possession of an E. M. F. of 640 volts, notwithstanding the fact that the original current had a force of only 4 volts. If now the condenser be charged by this secondary current in a similar manner, and the poles of the condenser be joined in series, an E. M. F. will be formed of sufficient electrical energy to generate a spark of one inch through the air. As may very readily be understood, this increase of intensity may not be had for nothing; it represents a proportionate loss of current.

The little pocket batteries, from which jewels for the stage or *salon* are lighted up by electricity, have often been described and sometimes illustrated in these columns for the readers of the SCIENTIFIC AMERICAN. At the Exposition they are shown, and their workings explained by an employe of the manufacturing company among the exhibits of which they are numbered. The little battery for the pocket is only 3 inches square, and before being used is charged from a galvanic cell of the common type. A very fine wire of silicious bronze comes up out of the pocket, and reaches to the jewels on the head. The turning of a little switch, which closes the circuit, is all that is required to light up the jewels.

A London manufacturer exhibits a number of the well known type of Faure-Sellon, formerly called the Faure-Sellon-Volckmar, secondary batteries. What makes these batteries particularly interesting is the alleged fact that some of them have been in practical use for nearly a year, and do not, it is said, show any diminution of their former power when properly charged.

They are connected up with several small motors and a number of lights of the incandescence type, and it may be said that they do what is required of them at least efficiently, if not economically, although it should be said on the part of their proprietor or agent, that he claims for them an efficiency of ninety-five per cent. They are said to be shown here particularly in the interest of a company which proposes to light up railway cars and steamboats, the current being furnished the lamps through the agency of these secondary batteries.

The Brush storage battery makes a very excellent showing in the halls of the Exposition, there being one of twenty-one cells in the gallery and another of similar power in the main hall used to run a loom. The form of this battery, though supposed to be a secret, is well understood to be a series of lead plates in a bath of sulphuric acid, having before this immersion been chemically prepared. The current used has an E. M. F. of forty volts, and is of about fifty-two amperes. Forty incandescence lamps, each of an intensity of sixteen candles, can be kept aglow in either series. Only one dynamo is required to charge the two series, and by means of an automatic current manipulator, the current is turned on or shut off from the dynamo, according to the necessities of the batteries.

A very ingenious and altogether new contrivance is the electrically operated propeller attachment for small boats. It is so arranged that any one who has a boat may attach one of these little machines to its stern, place the battery under the seats, and move about a river as though impelled by an invisible power. Curiously enough, the boat when fitted with one of these little propellers does not require any rudder; the propeller doing the steering as well as the propelling. One of these boat attachments has a battery of 12 cells, the plates being 4 in. x 4 in., a double induction motor and apparatus for propeller.

With such a battery, an ordinary boat would probably not make more than four miles per hour in still water, and possibly would not do as well as that, but with a horse-power battery—according to Molesworth's engineering formula, a horse-power is equal to the power displayed at the oar by about eight men—a much higher speed could be obtained. Of course, until electrical charging stations shall have been established along our river banks, whoever owns an electrical launch must need also possess a dynamo to charge its battery, and a steam engine to work the dynamo.

A particularly interesting mechanism is the semi-incandescence lamp invented by a Philadelphian and exhibited here. Unlike all other incandescence lamps, this one has no vacuum, but glows steadily in the open air. It cannot, of course, be said to be altogether original, save in the simplicity of its parts and its perfected movement. Reynier invented and Wiedemann improved a somewhat similar lamp, as will be remembered, though neither of these contrivances was of a practical nature, as is the one now shown in the Exposition. It is of about forty, perhaps forty-five, candle power in intensity, and can readily be fed by a small battery, say of ten cells; giving off a current of about twelve volts. The negative pole is of graphite of conical form, and bearing upon its inclined surface another piece of graphite, which represents the positive pole. This latter is free to move about, and as its tendency is to fall outward in the direction of the cone's base, an almost perfect contact is at all times had. To the metallic sleeve which contains the positive pencil is attached the positive wire from the generator, and upon the advent of the current the small positive pencil becomes incandescent by reason of its resistance to the current. Worn away by the current, this pencil recedes gradually by its own weight upon the negative disk, which latter disappears much slower.