A One Wheel Watch.

A curiosity in the way of watches was shown by Mr. E. Sordet, director of the Watchmakers' School at Geneva, before the horological section of the Society of Arts. This wonder is nothing less than a watch with one wheel, manufactured at Paris, in the last century, by a Mr. Gautrin. The watch was presented to the National Institute in 1790, being then in a deplorable state; but the teacher of the repairing section at the school, Mr. Emile James, has, after many hours of labor, succeeded in re-establishing harmony between the various organs, so that it is now in going order. The great wheel which gives the watch its name occupies the bottom of the case and the center of the plate; it has 60 teeth, and is 33 mm. in diameter. Its axis carries two pinions, one of which receives the motive force from a barrel, and the other carries the minute work. The function of this great wheel is quadruple. First it acts on a lift, then on a lever operating on another destined to lower the axis of the watch, and lastly on a third lever, the latter serving to return power to the great wheel at the moment when the action relents by the rise of the axis.

Value of Patent Property.

An illustration of the worth of a first class patent, for a device that everybody wants to use, is seen in the Bell telephone patent. The committee of three appointed by the Ohio Legislature to investigate the telephone companies in Ohio have prepared a report in which they say that there are about 12,000 complete sets of instruments in use in the State, all owned and controlled by the American Bell Telephone Company, of Boston. These instruments are leased to the local companies at an annual rental of $20 for each set, making the annual tribute paid by these local companies over $200,000. The cost of each set of instruments did not exceed $3.35. On instruments which did not cost the Bell company over $40,000, it receives over $200,000 annually. The Bell company, before granting a franchise to a local company, exacts from 30 to 35 per cent of the stock of the local company and from 20 to 25 per cent of the gross earnings of all toll lines. The committee declares that in its judgment the Bell company is an imperious and unconscionable monopoly, and should be restricted by legislation, or at least be taxed upon the commercial value of its instruments, and that it should be required to pay, in addition to the taxes upon its instruments, a tax upon gross receipts.

A new industry was created when the Bell telephone was invented, and great ability has been shown in the administration of the company's affairs from the commencement. To these facts the large profits are greatly due. Had the company's affairs been less wisely managed, probably it would not now figure before the Ohio Legislature as an "unconscionable monopoly," fit only to be plundered by the tax gatherers.

A Great Blast.

The San Francisco Bridge Company recently made a large blast with a view of obtaining 90,000 tons of rocks for constructing a sea wall at San Francisco. The quarry is a bluff, 60 feet high, at the water's edge at the mouth of Visitation Valley. Eleven tunnels in all have been run and four have been exploded, 11,000 pounds of Judson powder being used. Each tunnel was 50 feet long, and extended to an L, in which was the powder. From the L to the mouth of each tunnel rock and dirt had been "tamped" in as hard as possible. The four explosions were to occur successively, the first to loosen the cliff and make it easier for the second to become effective, and so on. The first explosion was awaited with some little apprehension by the harbor commissioners and other occupants of the tow-boat. But when it occurred, with a dull, heavy sound, and it became apparent that fragments of stone were not to fly through the air, there was a unanimous desire that the boat should move nearer the shore. The other explosions occurred soon after. No. 3 was a grand affair. A great section of the cliff was toppled over, and huge bowlders and tons of dirt rushed down to the water's edge. The blasts were pronounced successful, and the quality of stone, on subsequent inspection, seemed satisfactory to the harbor commissioners. It was estimated by the engineers that the 11,000 pounds of explosives had displaced in about 10 minutes 35,000 tons of rock and earth.

Spontaneous Combustion of Lampblack.

Fires occurring from spontaneous ignition of vegetable black are very common. Oily rags are more liable to self-ignition during the summer after a continuance of dry, warm weather. A sudden storm or a shower of rain appears to give life, as it were, to the parched-up matter, and a fire is the result. It has been also noticed that the reverse occurs after a continuance of wet weather. A few days sometimes are sufficient to set up active and rapid combustion, especially among sweepings in paint and oil stores, consisting generally of wood dust, dried vegetable and animal powder, colors more or less saturated with varnish, turpentine, oils, etc. Lampblack, if packed in a leaky cask when freshly prepared, condenses the atmospheric gases on its surface, which, owing to the porous nature of the substance, is very large in proportion to its weight. In condensation the gases give out a certain amount of heat, which under favorable circumstances is sufficient to cause the ignition of some inflammable substance accidentally present, which, by combining with the condensed oxygen, liberates heat enough to cause the ignition of vegetable black, which, when once started, soon spreads until the contents of the cask become red hot.

This spontaneous ignition is not infrequent in many large carriage factories, and builders' shops have been destroyed solely from this cause. To put it in printed paper would insure ignition from the absorption of the oil in the printing ink by the lampblack, generating gas which would soon ignite the soot or lampblack. One among many instances of well attested cases of spontaneous ignition is described in the *Paint, Oil, and Drug Review.* It occurred at a large carriage works at Grantham, England, in a shop far away from fire or the chances of a spark. The paint shop was gradually illuminated on a mild summer's evening during daylight. It was noticed through the workshop windows, and seen to be a tub of loose lampblack slowly consuming the cask. It was easily carried out on to the grass to finish its work. It was thought that, being near the grinding-paint stone, some oil had been splashed into it, or an oily rag dropped into the lampblack. The secret was soon found out by the palette knife being found among the ashes of the cask, having been carelessly dropped in with some wet paint on it; or even without any wet paint, the dry, oily paint which accumulates on the blade near the handle would be sufficient to cause ignition. It is not the large quantity of oil, but the small quantity, which is the cause of it. This is so well known, that some coach makers, when they receive lampblack, put it into a sound cask and pour enough linseed oil into it to saturate the whole.

AN ELECTRICAL STANDARD FOR MEASURING LIGHT.

Our large engraving represents a new form of arranging an incandescent electric lamp with reference to its use as a standard light for photographic purposes, and is the outcome of a long series of experiments by Mr. Thomas A. Edison and his assistant, Mr. John Ott, in charge of Mr. Edison's laboratory.

The problem of obtaining a steady light and a uniform current from a variable battery, with lamps of varying resistances, has been a puzzling one, but has recently been very ingeniously overcome; and it is our purpose to relate some of the incentives which led Mr. Edison to reach the result obtained.

During the past winter months the officers of the Society of Amateur Photographers, of this city, undertook to invent or provide some form of standard light which could be depended upon, to be used in testing the sensitiveness of different brands of gelatino-bromide dry plates. It occurred to them that possibly Mr. Edison might devise a uniform electric light, the actinic qualities of which, it was well known, would be invaluable for the kind of work to be undertaken.

The strength of the light required was to be equal to one candle power. When the matter was first introduced to Mr. Edison, he was of the opinion there would be no difficulty in obtaining a means of accurately measuring and controlling the resistance of such a small lamp, if a battery was employed.

The original plan was to interpose a known resistance in the main circuit with the lamp, which could be varied, and also an amperemeter or a voltmeter for measuring the variations of the current; but, after a large number of experiments, it was found impossible to make an instrument delicate enough to accurately measure the very low resistance in the lamp, which is said to be equal to about three-fourths of an ampere.

Mr. Edison then turned his attention to the utilization of the electrical compensation balance invented a few years ago by Prof. Poggendorf, which is generally recognized as being the most delicate method of measuring electro-motive force of batteries, and at the same time has the advantage of being entirely free from any detrimental polarization.

In this method of measurement the currents from two batteries are so balanced by the insertion of a variable resistance that, if a galvanometer is inserted in the circuit, no traces of a current can be perceived.

The arrangement as shown consists of a standard constant battery, a galvanometer, a key, a rheostat or resistance wire made in two sections, two parallel brass rods arranged directly above each section of the wire, provided with adjustable collars, which connect the bars to the sections of wire, and a switch, all fixed upon a base which rests upon a photometric testing box. Within the latter, supported upon a sliding board, is the standard electric lamp.

Hinged to this board is a long wood rod, which when the side of the box is closed, as it is intended to be for actual work, permits the operator to move the lamp at the open end to different distances from the sensitive plate, held in a plate holder slide, shown at the opposite end. The lamp is connected by flexible cords to the binding posts leading to the main battery and one of the sections of the rheostat wire.

The apparatus is intended to be used in the photographic dark room. The cell of the standard battery, S, is the standard by which the electro-motive force of the Fuller, or main lamp, battery, M, is measured.

The battery, S, which is comparatively new, was devised by Mr. Geo. Wirt, who is connected with the Western Electric Mfg. Co., of New York, and is a modification of the well-known Daniell battery. It is so constructed that the fluids cannot become disturbed or mixed through any slight jarring. It consists of three square bottles, 1¼ inches square by 4½ inches high, with a neck ⅞ of an inch in diameter by 1 inch long, securely clamped together with metal screw rods at the top and bottom, and held in an upright position by a light wood framework, as shown in the engraving. In the upper part of the adjoining sides of bottles I. and II. is drilled a small hole ⅜ of an inch in diameter, and in the lower part of the adjoining sides of bottles II. and III. are similar holes, all arranged to correspond with each other.

A soft rubber washer separates the bottles at the holes, making a water tight joint, and also acting as a support to hold in place a thin film of gold-beater's skin, through which the liquids must pass by the process of endosmose and exosmose, from one bottle to the other.

All of the bottles are filled with a dilute solution of sulphate of zinc; within bottle I. is placed a piece of sulphate of copper about the size of a pea, which changes the solution to a blue color; the copper electrode at the bottom is connected by an insulated wire, which passes through the cork to the back of the key, K. At the bottom of bottle II. is a small chunk of zinc, which collects any deposit of copper, should any pass through from bottle I.

In the top of bottle III. is suspended the zinc electrode, which measures about 1⅛ inches long by ⅜ wide and ⅛ thick; its conducting wire as shown passes directly to the galvanometer, G.

It will be noticed this arrangement gives a very constant battery which cannot polarize, as each electrode is completely isolated, and the separation of the bottles with the gold-beater's skin also prevents an easy mixture of the solutions. Each electrode is never endangered, but is kept immersed in a solution favorable to retain it in perfect condition.

The main or Fuller battery, M, has been somewhat modified, but consists of a zinc electrode inserted in the porous cup, in which has been placed a teaspoonful of mercury and a dilute solution of sulphuric acid and water.

In the glass jar are four carbon rods about one inch square, arranged to fit in each corner of the jar, connected by a ring of wire at the top to one conducting wire, which passes out through the top of the cell. The jar is filled with the usual bichromate of potash solution, known as electropoin. A metal screw cap secures a rubber cover to the top of the jar, and thereby prevents the evaporation of the solution. Six cells are employed, and are plainly seen, located on a shelf at the right, in Fig. 1.

The amount of resistance inserted in the series is a trifle more than the resistance of the lamp while hot, and consists of a length of 5½ feet of German silver wire $\frac{16}{1000}$ of an inch in diameter, divided into equal sections connected together at one end, as seen in the diagram of Fig. 2, near the key, K, by a metal link. One section lies upon the millimeter scale parallel with and directly under brass rod No. 2; the other also lies on the board under brass rod No. 1. The section of resistance wire under rod No. 2 is electrically connected thereto by a hinged metal pointed foot and adjustable collar, which may be adjusted to any point on the rod over the millimeter scale, and is secured by a set screw. The position of this collar is never changed except when a new lamp is to be inserted in the circuit. The section of resistance wire under rod No. 1 is electrically connected to the latter by a sliding collar provided with a spring, at the end of which is a grooved brass wheel about ⅜ of an inch in diameter, which bears directly upon the wire.

In the diagram, Fig. 2, the arrangement of the apparatus will be seen more clearly. S represents the "standard battery," G the galvanometer, No. 2 brass rod with fixed collar, No. 1 brass rod with movable collar, R resistance wire, which also connects with wire under rod No. 2, K key in the circuit of standard battery, L the electric lamp.

In order to intelligently understand the operation, we will detail the two different circuits of the batteries.

The circuit of the Fuller battery, M, is from the positive or carbon pole of the battery to brass bar No. 1 (see Fig. 2), through the collar, spring, and wheel to the German silver wire, R, to the lamp, L, and then back to the negative or zinc pole of the battery. It will be seen that by sliding the collar on rod No. 1, the amount of resistance in this circuit is easily increased or diminished.

The circuit of battery S is from the positive or copper pole through the key, K, to the resistance wire, R, thence through the pointed foot and fixed collar to brass bar No. 2, through the galvanometer, G, and back to the negative or zinc pole of the battery.

In the lamp circuit a switch is inserted for turning the current on and off when testing.

It will be noticed that there is a section of the resistance wire, R (the amount between the end connecting with key, K, and the pointed foot under rod 2), through which the current from each battery flows; and although the current from the main battery, M, has a circuit independent of the galvanometer, it is in this section of wire that both currents are brought into juxtaposition and the electro-motive force of the main battery compared with that of the constant battery, S. The variation is at once noticed on the galvanometer, and is easily regulated, as will be hereafter described.

Fig. 3.—SENSITOMETER SCREEN.

In operating the lamp, the switch in the lamp circuit is first turned on, then the key, K, is pressed, which brings the current of the standard battery, S, into opposition to the current from the main battery, through the galvanometer, G. If the electro-motive force of the main battery is too weak, the needle of the galvanometer will be sent to the right of zero a few degrees by battery S; but such movement is at once overcome by diminishing the resistance in the main circuit through the sliding of the collar on rod No. 1 toward the left, in the direction of key, K. As quickly as the resistance is cut out by this movement, so is the needle of the galvanometer forced back to the left until it reaches the zero point; then the batteries are exactly balanced, and the light obtained is equal to that of a standard candle; at this zero reading we have also a constant number of volts of electro-motive force.

A bunch of twenty lamps accompany the apparatus, and may be seen resting upon the base board near the galvanometer. Although all of the lamps may possess the same electrical resistance, they will not emit an equal amount of light, hence in inserting a new lamp it is necessary to locate the hinged pointed metal foot under the brass rod No. 2 at a different point on the millimeter scale, to correspond with the number marked on the label attached to each lamp.

The mode of testing the candle power of each lamp is to first set the hinged pointed foot arbitrarily at some number on the millimeter scale, then to turn on the switch of battery M, and gradually slide the wheeled collar from the extreme right hand end of rod No. 1 to the left until enough resistance is cut out to make the intensity of the light from the lamp equal the light of a standard candle, and at the same time to see that the reading of the galvanometer is zero.

The average of a large number of photometric readings is taken to determine the uniformity or the intensity of light emitted from the standard candle.

In view of the differences in the lamps, each one is marked with a special number, which is the separate test, as was shown on the millimeter scale, when it was originally tried, and is to be used when the lamp is put into the main circuit of battery, M, in the manner previously described.

The electrical standard of light thus obtained is far more constant and reliable than that obtained from the standard candle in that all variation of the flame or the uncertainties of the wick are avoided. The galvanometer employed is of the ordinary pattern, having an estimated resistance of about 500 ohms.

As soon as any blackening occurs on the interior of the globe, or even before it, which is due to the gradual destruction of the carbon film from long use, the lamp is removed and a new lamp substituted.

The lamp when employed in making the photographic tests is used but a few seconds at a time, and it is estimated one lamp will, on this account, be good for several thousand tests before the variation of the light will amount to more than one per cent.

Much credit is due to Mr. Edison and his assistant in working out the practical details of the apparatus, and the simplicity and delicacy by which the resistance is employed to control the current of the variable battery is especially commendable.

So delicate is the balance that the resistance of a quarter of an inch of the resistance wire can be read on the galvanometer.

The application of the light in testing the sensitiveness of photographic dry plates may be described as follows: A sensitive dry plate is placed in contact with a Woodbury carbon screen (see Fig. 3), such as is used in a Warnerke sensitometer, in a plate holder, and the latter is set into a groove at one end of the testing box, the slide protecting the plate from all light, then being withdrawn, as shown in Fig. 1. The electric lamp is then placed so as to be opposite the center of the screen and twenty-four inches therefrom. The switch putting the battery M in circuit is now turned on, and the light emanating from the lamp is allowed to act upon the screen for twenty seconds; it is instantly stopped by turning off the switch.

The sensitive plate is next removed from the plate holder and placed in a developing solution of a given strength for five minutes, and it is then taken out, washed, and immersed in a fixing bath of hyposulphite of soda until the bromide of silver film unacted upon by the light is dissolved out. It is again washed, and when dry is laid film side down upon a piece of white paper. The highest number on the finished negative which can be seen represents the sensitiveness of the plate, and by means of comparative tests the relative sensitiveness of different plates is thus easily determined.

It should be mentioned that the Woodbury screen (Fig. 3) is a plate of glass coated with a film of carbon tissue divided into squares, and is made by exposing the sensitized tissue behind another negative screen having similar squares, for a certain number of minutes to the light of the sun, and afterward developed, by dissolving out, with hot water, the parts of the film unacted upon by light. Each square is shaded to be a trifle more dense than its neighbor, and they are distinguished by numbers.

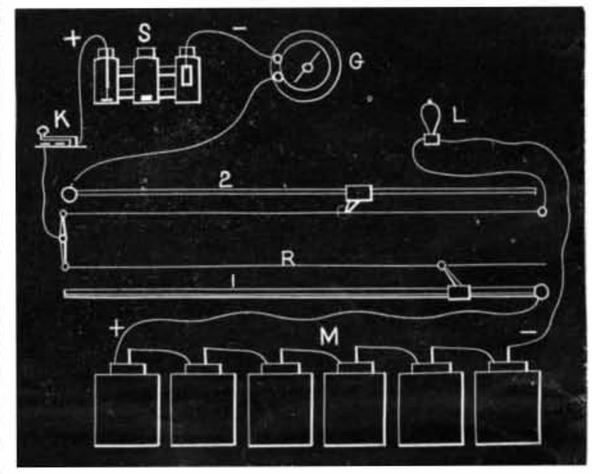

Fig. 2.—DIAGRAM OF CIRCUITS.

No. 1, it will be noticed, is quite transparent, while No. 25 is nearly opaque. The row of figures at the bottom is intended to show in a more compact way the difference in the shading.

A sensitive plate showing a reading of 25 will be regarded as having an extreme degree of sensitiveness; and other things being equal, such as freedom from fog in the film, will be excellently adapted for taking instantaneous pictures. One showing 14 would be considered very slow, but excellent for copying or for ordinary landscape work. Nearly two hundred tests have been very successfully made with the lamp, and it forms a valuable addition to the photographic laboratory. In addition to its application to photography, the light may be used for many other purposes, such as comparative photometric tests with other kinds of illuminants. It forms a ready and convenient standard for use in the laboratory, or even for use in gas works, and is an improvement which has long been sought for.

Mr. Edison and the Society of Amateur Photographers are to be congratulated on their success in at last having found a practical method for the more exact measurement of light. It is a matter of scientific interest to the community at large, and is well worthy of the attention of all who are in search of a standard light.

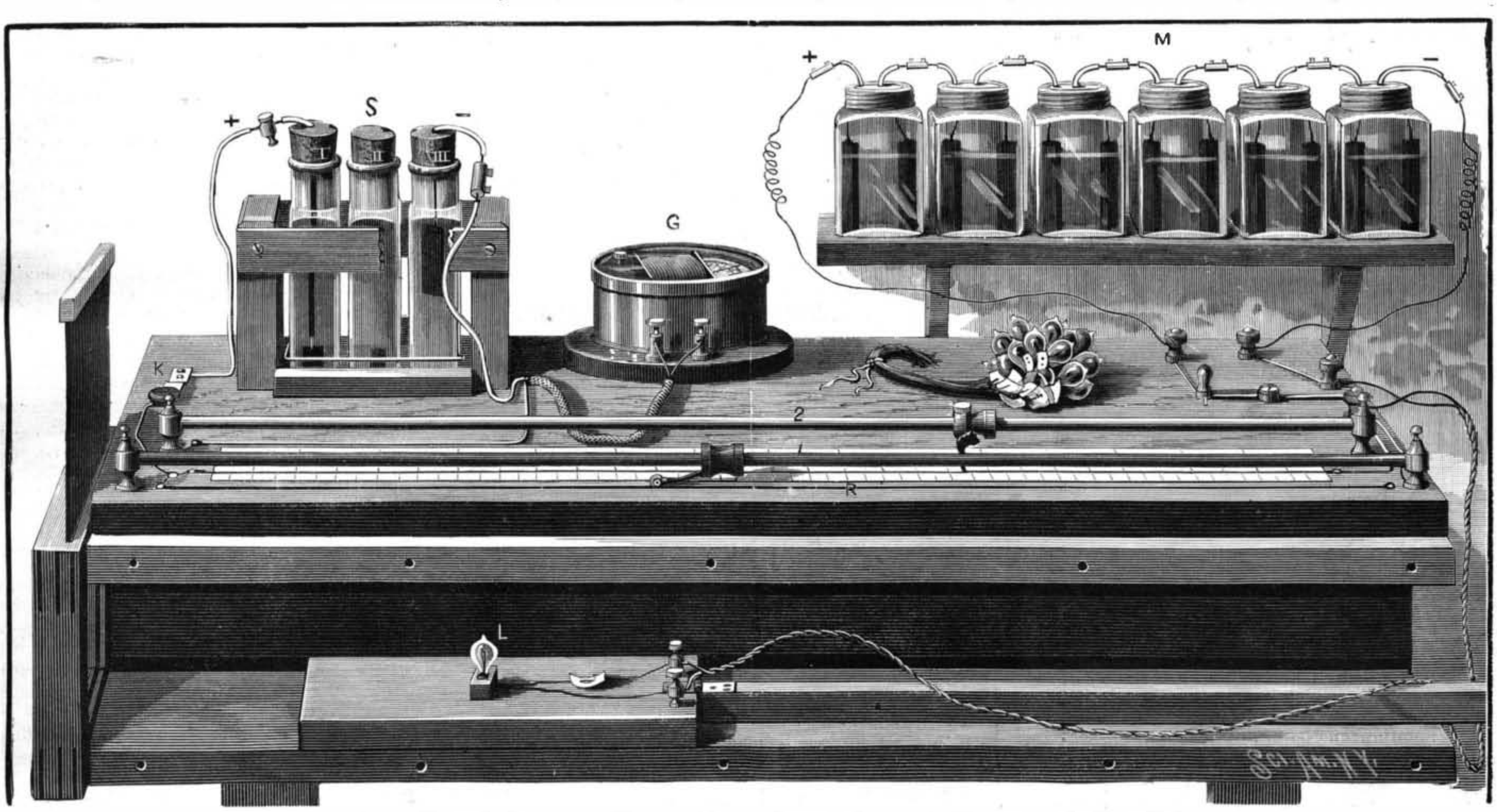

Fig. 1.—ELECTRICAL APPARATUS FOR MAKING PHOTO-SENSITOMETRIC TESTS.