1.—PLAIN PLATES.

No. of cells.	Effect produced.
1,000—Slight sparks just commencing on completing circuit.	
1,080—Sparks evident.	
1,200—Sparks frequent and abundant.	
1,500—Continuous arc.	

2.—SERRATED PLATES.

No. of cells.	Effect produced.
1,000—Sparks just commencing on making contact.	
1,080—Spark evident.	
1,200—Sparks frequent.	
1,500—Continuous arc, but fitful.	

2,000 cells in each produced a continuous stream of electricity. The effect with 1,500 cells was decidedly more marked with the plain plates than with those serrated. The experiments were extremely pretty, and very decided in their character.

Hence it appears that grooving is not only of no use, but that it rather deteriorates the value of the protector.

These experiments confirm very decidedly the accuracy of the figures obtained by Dr. Warren de la Rue and Mr. Muller on the striking distance between two flat disks, given by them in their paper read before the Royal Society (Phil. Trans., p. 169, 77), where it was shown that 1,200 cells struck across 0.312 inch. Hence 1,000 cells struck across 0.01 inch, which agrees perfectly with the curve produced by those observers.

It is the practice in the Post Office Telegraph Department to keep these plates apart by thin paraffine paper, 0.002 inch thick, so that the air space is really much thinner than that experimented upon, and the striking difference of potential only 250 volts.

Messrs. De la Rue and Muller have shown that for points and various kinds of surfaces opposed to each other, plain surfaces act the best for potentials less than 1,500 volts, and that points are only efficient for high potentials. Now, as it is doubtful whether atmospheric electricity causes much higher potential in telegraph wires than 1,000 volts, it is clear that plain surfaces are the most effective for protecting apparatus. It is quite certain that such plates, plain and smooth, separated by an air space 0.002 inch thick, will form very efficient lightning protectors.

The author is very much indebted to Dr. Warren de la Rue for the performance of experiments in his laboratory.

THE BROOKS UNDERGROUND TELEGRAPH CABLE.

A NEW system of insulating underground telegraph wires has recently been experimented on by the Silvertown Telegraph Company. It is the invention of Mr. Brooks, an American, and differs from all others in the fact that the material employed for maintaining the insulation of the line is a liquid—paraffin oil—which is known to possess for this purpose qualities of the highest order; and in laying it, the wires—thirty, forty, or fifty, as may be required—covered with cotton binding, and placed in an iron pipe, conveniently located, and the pipe line filled with oil—allowed to run in until full, the maintenance of the supply being assured by providing an elevated vessel of the material at intervals, so that a constant pressure will be kept within the pipe. All qualities of oils do not answer for this purpose, and there was great difficulty in finding the right kind of oil. In testing this wire, it is found that the oil electrifies to a much greater extent than any known insulator. The specific electrostatic capacity is extremely low. Tests made in America show it to be one twenty-seventh of that of ordinary gutta serena. This, as all electricians know, is a great point in its favor for underground wires. There are several lengths laid and at work in and near Philadelphia.—*Journal of the Society of Arts.*

STARCH PHOTO PLATES.

The process adopted by Messrs. Ferrars and Pauli, of Barcelona, Spain, is as follows:

Potato starch	4 grammes.
Water	20 cub. centim.

The starch is placed in a mortar with a few drops of water, and well triturated and beaten up until it assumes the form of a thick paste, with which the 20 c.c. of water are then thoroughly mixed. The object of the trituration is to crush the starch grains, and thus to enable the water to be completely incorporated with them, the result being a more homogeneous or smoother mixture. In another vessel, capable of standing heat, the following solution is prepared:

Water	80 cub. centim.
Potassium bromide	1.12 grammes.

This solution is raised to boiling point, and the first, or starchy, liquid is gradually dropped into it, keeping it, at the same time, vigorously stirred. As they swell, the grains of starch will be completely impregnated with the potassium bromide, and this is a most important condition in securing a good emulsion. Still keeping the mixture hot, the following solution is added drop by drop:

Distilled water	20 cub. centim.
Silver nitrate	1.62 grammes.

In order that the double decomposition may now be effected, shake the mixture energetically, and without cessation, until the operation appears to be completed, which will probably be at the end of eight or ten minutes. Next pour the emulsion on a glass plate, placed in a horizontal position, and so soon as it has set sufficiently, wash it with pure water. Redissolving the paste, filtering, coating the plates, and drying are carried out as in the ordinary gelatin-bromide process. From the higher permeability of colloidal substances—such as starch, arrowroot, sago, etc.—the authors draw a conclusion highly favorable to the superior rapidity of emulsions formed of these substances. There is also, as they observe, a marked economy in the employment of starch emulsions, and to render them firmer and more capable of development they suggest a mixed emulsion of gelatine and starch.

QUANTITATIVE DETERMINATION OF CADMIUM.

By F. BEILSTEIN and L. JAWIN.

THE authors dissolve the precipitated cadmium sulphide (or oxide) in nitric acid, neutralize with potassa, and add potassium cyanide till the precipitate is just redissolved. The liquid is then, if necessary, diluted with

water so that 75 c.c. may contain about 0.2 gm. cadmium. The beaker, with the solution, is then placed in a capsule with cold water, the platinum electrodes are introduced, and the glass is carefully covered to prevent loss by spitting. Three Bunsen elements are required for precipitation. Toward the end of the experiment the glass cover, the electrodes, and the sides of the beaker are rinsed down into the liquid, and the current is allowed to pass for some time longer. The completeness of the precipitation may be ascertained by testing the liquid with sulphuretted hydrogen. The precipitated cadmium is washed first with water, then with alcohol, and dried in a heated platinum capsule.

FISCHER'S PYROMETER.

THE principle of this pyrometer is based upon the difference in fusibility of different metals or alloys. A fireproof tube of about 2 to 3½ inches in diameter extends into the furnace or stove, and in this tube a small crucible is suspended from a wire that is not very fusible. A second perforated crucible is suspended from the short arm of a lever in such a manner that it is exactly above the first crucible. The other end of the lever is provided with an electric contact. A certain quantity of a metal or an alloy, the fusing

point of which is known, is placed into the perforated crucible. As soon as the heat in the furnace has reached the fusing point of this metal or alloy it will melt, and drops through the perforations, thus decreasing the weight on the smaller arm of the lever. The longer arm will drop and close the circuit, which actuates a signaling apparatus and indicates the time on a graduated disk. The molten metal is removed and replaced by metal of a higher fusing point, and the experiment is repeated. From the fusing point of the metal in the perforated crucible the heat in the furnace can be determined.—*Chemiker Zeitung.*

SEWER VENTILATION IN BERLIN.*

THE sewerage system in Berlin is a water carriage system for all rain, domestic water, and water closets, with this valuable alteration, that not one gallon of sewage is allowed to enter the river. Each sewerage district has one leading intercepting sewer collector, in which the whole sewage, by other intercepting sewers, empties. The whole contents are collected in a large water-tight well, which is called the stammi end of the collecting sewer. This well or cylinder basin is thirty feet in diameter and several feet below the mean water level, and is provided with an outfall sewer toward the river, in cases of immense rainfalls and floods of extraordinary extension. This basin is provided with a strong grate to retain the solids of the sewage. The liquids enter a cylinder in the center about eight feet in diameter, and are from here distributed by different pipes into the pumping basins. From each pumping station the water is pumped to the irrigation fields, which are located in a circle around Berlin at an average distance of 11½ miles. The fields absorb all the fertilizing ingredients, and filter the water perfectly through the soil before the same enters the river. The average lift of the sewage is thirty-six feet in height, and is conducted through wrought iron pipes, with three feet diameter, to the irrigation fields.

The manner of ventilating most effectually has been a matter of some doubt, and the Berlin sewerage commission has given this important point in city sewerage full attention, and they have tried almost every suggestion made by prominent engineers. A perfect ventilation is essential to all structures, and especially to those which contain bad air and sewer gases; the latter often cause a great pressure against the house connection traps, and enter the dwellings to the great detriment of the inhabitants. The commission in Berlin brought the ventilation in practical operation through large manufactory chimneys and expressly constructed air shafts, which they had provided with suitable furnaces, to draw out all bad air, gases, etc. But they soon found that this drawing of the air by heat cannot be well regulated, and for this reason does damage, for by strong draughts it opens the traps in the dwellings next to the furnace, and consequently allows a large portion of the sewer gas to escape through the connecting pipes to the dwellings. In addition to the difficulty mentioned, they experienced some explosions, and the great risk they ran with this manner of ventilation caused them to abandon it, after they had ample proof of its impracticability.

Then they employed, like Hamburg and other cities, the house rain conductors for ventilation, and connected for this purpose the trap with the water conductor, with the intention of leading the noxious gas to the highest point of the house. They found that in a good many instances it worked only part of the time, owing to the air current, and in others it did not work at all, on account of the location and different height of houses; but the worst of all was, that the gas escaped in large quantities through the joints of the conductor, and permeated the sleeping rooms of the upper stories to such an extent that the people within had to keep their windows shut, thus being deprived of fresh air altogether.

The next trial was a connection from the traps to the smoke flues, and all flues so used were tapped with different kinds of ventilators of light motion to aid the upward draught, but it was proved here positively that the difficulties are

greater in practice than are imagined or expected in theory, and therefore this plan has also proved unacceptable, as in most cases it brought the noxious gases directly into the rooms of the houses so connected.

Next, they tried, like many other cities, to use the sewer gas for additional street lights, after they failed in the attempt to burn it by conducting the gas into the boiler fires of the factories. They erected on all corners where sewers intersect galvanized iron cylinders, and provided for a lantern with appropriate caps, constructing, in other words, new lamp posts, and connected the broad footing with a conduit to the sewer. The theory was that this idea was an excellent one, but in practice the sewer gas had a chance to escape by the draught of the very atmospheric air which should have aided in the burning of the gas jet. It drifted toward the windows, and had to be abandoned in consequence thereof. The more the sewer building committee found the absolute necessity of ventilating the sewer system, the more important became the originally very small item of ventilation, and to-day a great many engineers have found that the practical difficulty is in reality enormous, notwithstanding all feasible theoretical plans.

The following plan is the only one which has proved successful, and the very thing to be adopted in Washington, outside of the charcoal air filter. It consists of the following: In all new houses a large and well-glazed round stone pipe is to be placed in the inner wall of the house between the two prominent smoke flues, with all joints well cemented, solidly walled up in an air-tight wall and extended to a considerable height above the roof, or so as to be elevated to the same height as the neighboring house. This special flue, the top of which is provided with a charcoal filter, is then connected with the trap located between the house drain and the street sewer under the sidewalk. It has proved to be very effective, and relieved the dwelling houses in all cases almost completely of the noxious gases.

For the street sewers, they have in use, in a large number of European cities, charcoal filters, which serve to filter the bad sewer air to some extent before the same escapes into the streets.

The charcoal ventilators in the Berlin sewerage system are placed in all entrance shafts, where at the same time all sewage wells are located, which form at the street crossings the connect on between the different sewers. These shafts are the ventilating medium for every sewer section.

Several kinds of ventilators are in use, and no definite decision has been made up to this time; it has been stated that the Rawlinson charcoal ventilator does not fill the statement made, and is not up to his own promise, many others having proven to be more effective and superior.

It is the unanimous opinion of all European sanitary engineers that sewers should have as much ventilation as possible, and in order to bring plenty of change of atmosphere about, not less than fifteen ventilation shafts should be in every mile, and the same provided with the best charcoal air filters. Plenty of fresh air and a low temperature in the sewer, and a rapid discharge of all fresh matters into a large collecting or intercepting sewer, with a still larger quantity of air, will prevent, to a very large extent, the formation of offensive gases. In connection with the above is an order for the gang of men working in the sewers, which forbids by heavy penalty the least stirring up of the sewage, or the stoppage by the existing locks, unless it is for reason of repair an urgent necessity. This order is as strictly enforced as a military rule, and is the result of practical experiments; for all gases were driven into the houses by the least stirring up, which heretofore has been often the case under the pretext of cleaning. A sewerage system, properly operated and totally disconnected from the effect and influence of river water, cannot help to be of beneficial service and preserve the sanitary condition of a city.

All house connections to sewers are made under the rules and superintendency of the permanent building commission of the city of Berlin. This commission consists of twenty appointed architects and engineers, to whom every plan for all improvements or alteration is to be submitted and approved of in all details before the proposed improvement can be made. Under the rules and regulations which govern this commission is one which bears directly upon the house ventilation, and is to the effect that every water closet must have a six inch round, air tight pipe, connecting the water closet basin proper with the atmosphere at the highest point above the roof.

All rain water collected by gutters and conductors of houses is not allowed to discharge free on sidewalks or streets, but is to be led in all cases into the house drains at a point between the house and the trap. This order is entirely new.

All cesspools and old-fashioned privies are closed by law, and the further use of them has to cease as soon as the sewage of a single district or part thereof with its connection is completed and ready for use; and it is obligatory on every owner of property, or the assignees thereof, to construct not less than one water closet and connect the same with the street sewer at such point as designated by the sewer commission.

In case of a failure to comply with this law within the time specified, the work is executed by order of the chief of police, under the direction of the sewer commission, and expenses so incurred are a special and preferred lien on the property until paid.

They have disconnected the streets, sewers, and sewage management from the street building and engineer department proper, and while it is self-sustaining, the special sewer tax sum included, in a few cities, they endeavor to obtain the same result all over Europe. From what I have learned on taxation, the property is divided into three classes, and the tax for sewage collected per square foot from one-quarter of a cent upward, allowing three water closets on every premises, and \$2 per annum for every additional water closet. The national government of the German Empire has aided the capital of construction with a very large sum on account of parks and public thoroughfares being held in common with the citizen, and they pay a tax on all property, like every individual citizen, every department being taxed separately and paying separately out of their annual appropriation fund. According to the example of cities in France and England, it is agitated in Berlin to aid all citizens who prove to be actually poor and unable to raise money on account of mortgage on their property, said aid to be given in two ways, as follows: First, in 50 per cent. of the cost of proper water closet and connection; and second, in the provision in alleys for trough closets, the latter being a modification of the water closet, consisting in one basin for several houses, provided by the city hydrant with water, and under control of an employe of the sewerage commission.

Like other cities in England and on the European continent, Berlin has urinals and water closets for public use.

* Condensed from the report of Engineer Karwiese, of Washington, on the Sewage Systems of Europe.