The current is taken from the commutator cylinder by twelve brushes, six on either side, either one of which may be removed without disturbing the others. These brushes are supported by an arm capable of being rotated on an axis coincident with the axis of the armature, so that they may be made to approach or recede from the neutral point, and in this manner control the current.

This machine will furnish a current to eight hundred incandescent lamps. According to the most recent estimates as to economy, as obtained by indicating his present engine with 500 lamps, three and a half pounds of coal burned under the boiler per hour will generate a nett current sufficient for 8¾ incandescent lamps of 16 candles each, or 16 lights of 8 candles each.

IMPROVEMENTS IN THE SILVERING OF MIRRORS.

Astronomers, and all who are interested in the production of mirror surfaces for optical purposes by the deposition of silver upon glass, will learn with pleasure that this subject has been receiving practical attention at the hands of a painstaking experimentalist, Professor Piazzi Smyth, the Astronomer Royal for Scotland. Convinced of the great value of reflecting over achromatic telescopes for certain phases of astronomical research, Professor Smyth has lately been directing his attention to the eliminating from the film of deposited silver certain objectionable features which marred its usefulness when applied to the reflector or glass mirror of large reflecting telescopes.

Subject to slight improvements to be afterward mentioned, the quickest, best, and most reliable method of depositing silver on glass, and that by which large glass specula as well as flat reflectors for a heliostat have been prepared by this astronomer, is the following:

Solution A.—175 grains nitrate of silver dissolved in 10 ounces of distilled water.

Solution B.—262 grains of nitrate of ammonia dissolved in 10 ounces distilled water.

Solution C.—1 ounce of caustic potash, purified by alcohol, in 10 ounces distilled water.

Solution D.—Half an ounce of sugar candy and 32 grains tartaric dissolved and boiled for ten minutes or so in 5 ounces distilled water. When cold add 1 ounce of alcohol, and make up to 10 ounces with water.

To Mix.—Put one-quarter of A into a glass beaker, add one-quarter of B, and then, gradually, one-quarter of C. Stop if it gets cloudy and add a drop or two of B, and continue with one-quarter of C until it is all got in. Then add a drop or two of A till the mixture has a slight brown color that will not dissolve in a couple of minutes; let it settle, or filter through cotton wool. To this add one-quarter of D, when the glass is ready to put on.

The quantity of the whole should be such that when the glass is placed on the fluid there should be about a depth of three-quarters of an inch below it. If everything is right, the mixture will turn first a pale sherry color, and then an inky black. In ten minutes in hot weather, or twenty minutes in winter, deposition will be completed, afterwhichthe mirror is then removed, washed, dried, and polished with a rouged pad.

From an observation of the fact that the silver formed much more readily on glass lying on the top of the solution than that which lay in the bottom of the vessel, a little going downward, but by far the greater portion ascending, Prof. Smyth reasoned that the so-called silver could not be pure silver after all, but must be combined with some substance that has altered its specific gravity. To that substance, which he concludes is potash in some form, he attributes the further fact that a damp warm thaw coming on after cold will sometimes cause the polished film to leave the glass and rise up in blisters. By what means, therefore, was this hygroscopic element to be eliminated? All difficulties are overcome by lifting the mirror from the silvering bath, and after allowing some of the solution to drip off, transferring it to a bath of alcohol, into which it is allowed to remain, with gentle agitation, till no more coloring matter is given off. A great advantage is also found in the substitution of soda for the potash in solution C, using much less of it. The effect of the alcoholic bath is noteworthy and valuable. A more perfect adhesion to the glass, with consequent freedom from the blisters mentioned, added to the greater smoothness and amenability to the action of the rouge polishing pad, are among these advantages.

An effective way of cleaning the surface of the glass previous to its being silvered consists in rubbing it with nitric acid, which must then be wiped off with a cloth, followed by an application of powdered Spanish whiting, to which is added enough distilled water to make a paste. This is rubbed over the surface and allowed to become quite dry, when, by rubbing with cotton wool, it is all removed. On being seen to be dry and clean the plate is gently lowered, face downward, into the solution, taking care not to sink it so low as to allow the back to get wetted. The film, thus obtained possesses great body, solidity, and luster after being rubbed with the rouge pad, these qualities being very apparent when compared with a film obtained by the older processes.

THREE car loads of silkworms' eggs, consigned to George Carhart, and valued at $1,000,000, arrived in this city at 6 o'clock on Wednesday morning, January 5, by the Erie Railway, and were immediately put on board the French line steamer for France. They came from China, reaching San Francisco on the 28th ult.

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NEW YORK, SATURDAY, JANUARY 22, 1881.

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(Illustrated articles are marked with an asterisk.)

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For the Week ending January 22, 1881.

Price 10 cents. For sale by all newsdealers.

PHARAOH'S SERPENTS—ARE THEY DANGEROUS TOYS?

Serpents' eggs, or, as they were at first called, "Pharaoh's serpents," are much more easily produced than their extraordinary properties and the high-toned sound of the name, mercurous sulphocyanide or sulphocyanide of mercury, would indicate. For this mercurous sulphocyanide is a very fine, white, soft-feeling powder, and when wet up with weak gum water may be kneaded or moulded into any desired form. In early days the standard form was a cone about one-third of an inch high, and the conical masses, after drying, were covered with tin foil. Of late the pill form is the fashion.

But the mercurous sulphocyanide is not a commercial article, and perhaps there are not in all the world half a dozen stores where it is kept in stock; probably its only industrial application is to be found in the serpent manufacture. Moreover the raw materials, which, by a direct and simple process of mixture, result in the production of the mercurous sulphocyanide, are not commercial; these materials are sulphocyanide of potassium and nitrate of mercury. When solutions of these salts are mixed, the mercury and potassium change places, and immediately there result mercurous sulphocyanide, the serpent constituent, which precipitates, and nitrate of potash (saltpeter), which remains in solution. The foregoing is all the instruction which a chemist should require to understand and execute successfully the serpent making process; he should know what materials to start with and how to manage them. For tyros and others who may be concerned to know it, we give the complete process from the beginning:

Mix intimately two parts of yellow prussiate of potash with one part of sulphur; carefully melt this mixture in an iron or porcelain vessel at a gentle heat, far below redness, stirring all the time with an iron rod. The melting is successfully completed when the mass has become a tranquil liquid and will not throw up any more gas bubbles. On cooling you will have a black, brittle mass, from which water dissolves the sulphocyanide of potassium. Next dissolve mercury in diluted nitric acid, taking care that at the end of the process there shall still be undissolved mercury; you have then a solution of protonitrate of mercury. Dilute filtered solutions of the nitrate of mercury and of the sulphocyanide of potassium are to be prepared and to be mixed by pouring the former into the latter as long as a precipitate is produced. This precipitate is the mercurous sulphocyanide (the serpent substance), which is to be collected, washed, dried, etc.

When these marvelous serpent toys were invented, about twenty years ago, they were admired and talked about all over the world; there was a popular enthusiasm over them comparable in earnestness to that which sixty years ago greeted Sir David Brewster's kaleidoscope. But to-day it is the temper of the people to scotch Pharaoh's serpents, while Sir David's toy is as popular as ever. The fact is, the kaleidoscope is one of the joys forever, and the serpents belong to the breed of the venomous. The venom of Pharaoh's serpents is mercury.

Pharaoh's serpents at first were made and sold on a great scale, and it was not long before their vicious traits were manifested all over the country. At one of the serpent factories in this city, where the work was performed mostly by girls, it was found that about one in ten would be prostrated on the first day at the factory, and that a majority of the employes would be visibly injured within the first week of their stay by mercurial poisoning. Among the curious cases which turned up was that of an employe who continued in the business from first to last in the most robust health; he seemed to thrive on the mercurous sulphocynide which he was continually, one way and another, taking in, and thus to elucidate the old adage of meat and poison. We have known a person who could not with impunity touch mercury or remain in a room where a small surface of mercury was exposed to the air. When the eggs are ignited one of the products of the combustion is mercury in vapor.

We are constrained, therefore, emphatically although regretfully, to condemn Pharaoh's serpents as dangerous toys. Perhaps they may be permitted among the brilliant experiments of the chemical lecture, but for children to play with—not at all.

These remarks are suggested on reading a letter from an esteemed correspondent who thinks that the serpents may not be dangerous. He says he has made hundreds of them and has suffered no evil. If all the dangerous things were fatal, there would be no survivors to sound the warning.

ICE ROADS AND RAILWAYS ON ICE.

As soon as the St. Lawrence River is firmly frozen about Montreal the work of constructing winter ice roads is begun to connect the city with the mainland. As described in the local papers the method of making the roads is simple, and in frosty weather the work is easy. The track is first marked out by lines of small bushes; then the rough surface of the packice is hewn smooth and the fragments cemented by pouring on water. There are two roads to Longueuil, one rounding the corner of Ile Ronde and the other passing the eastern end of St. Helen's Island. The city pays half the cost of maintaining the lower road, while it constructs and maintains one-half of the upper road. The Laprairie road, which passes beneath the piers of Victoria Bridge, is located and constructed by the Laprairie authorities, the city of Montreal paying one-half the cost. The St. Lambert road is constructed and maintained jointly by the city and St. Lambert, each paying one-half the cost of maintenance. The iron road or the ice bridge railways between Hochelaga and Longueuil, is a much more difficult and expensive affair. The surface has to be carefully leveled, then the sleepers are securely frozen in, and the track laid in the usual way. Last winter the Northern Pacific Railway used an ice road across the Missouri River for construction trains, transporting in this way a vast amount of material for the road beyond. During the present season the Russians have adopted the same plan for a freight railway on ice between Oranienbaum and Cronstadt.

ELECTRIC ILLUMINATION AT MENLO PARK

To subject his system of electric lighting by incandescence to the crucial test of actual outdoor use on a large scale, Mr. Edison has set up at Menlo Park a plant embracing five hundred lamps distributed over an area one mile long and half a mile wide. His laboratory stands upon a gentle eminence from which the lines of lamps extend half a mile to right and left, the entire area under illumination being, from the slope of the land, easily visible from the central station.

The lamps are in a circuit comprising seven miles and three-quarters of wire, and are supplied by a current generated by nine dynamo-electric machines driven by one engine. The lamps are of sixteen candle-power, equal to an ordinary street gaslight, and are absolutely steady, shining with a mild and serene effulgence, which is exceedingly pleasing to the eye. The division of the current is complete and economical, and the entire system of lights can be turned up or down, off or on, as easily as one can regulate the flow of gas in an ordinary burner.

Simply as an exhibition of perfect illumination under perfect control, covering a vast area, this array of lamps presents a most remarkable and delightful sight, and is alone well worthy of a trip to Menlo Park. As a demonstration of the perfected working of a great and novel system of illumination, sure to become in a little while a potent contributor to the comfort and economy of city life, it is a spectacle which cannot fail to impress powerfully the mind of any observer.

The lamps have been but slightly modified in form and construction, since they were figured and described some months ago in this paper. In principle they are unchanged. The present appearance of the lamps is clearly shown on our front page; the plan of suspending the lamps as in the chandelier, serves particularly well in elevated lights, since the shadow of the fixture is thereby avoided. Three sizes of lamps are made, one-third, one-half, and full size, or equivalent to $5\frac{1}{3}$, 8, and 16 candles respectively. Unlike other electric lamps the incandescent lamp requires no attention; there are no carbons to change, and need not be touched save to keep the outer globe free from dust, during the entire period of its existence, which covers several months. In case a lamp is broken by accident of internal defect, another can be put in its place as easily as a candle can be set in its socket. The suspension of one lamp has no effect whatever on the others in the circuit. According to the latest tests, to supply the current for one lamp of 16 candle power, for one hour, requires the consumption of two-fifths of a pound of coal. Still greater economy of power is expected by the use of the large generator now approaching completion.

THE TEHUANTEPEC SHIP RAILWAY.

The prompt and cordial acceptance by the Mexican people of the feasibility and the entire practicableness of Mr. Eads' plan of a ship railway across the Isthmus of Tehuantepec is probably without parallel in the history of nations, as it is in the history of great undertakings. Scarcely less remarkable is the generous spirit with which the Mexican Government has welcomed the enterprise. The liberal concession which it has granted to Mr. Eads gives him the right to construct a ship railway on the plan illustrated and described in the SCIENTIFIC AMERICAN of Nov. 13, 1880, on any line that he may select, the work to be begun within two years from the date of the grant and completed within twelve years. He is to have a right of way across the Isthmus half a mile in width, with an additional half mile of width where stations are required; also a subsidy equal to 1,000,000 acres of public land, to be located on the Isthmus or elsewhere, toward the construction of a harbor on the Pacific Ocean.

The grant gives, further, the right to acquire the Tehuantepec Railway, now building, and to improve such rivers and harbors as may be of use to the ship railway service, collecting tonnage dues from vessels entering them. Liberal tariff charges are allowed for transporting ships over the road and for auxiliary service; and the enterprise is exempted from all export and import duties on money and material during the entire period of the grant, ninety-nine years. At the end of this time the government is to take possession of the works, paying therefor two-thirds of their value. Permission is given for the United States Government to lend its aid, thus making our Government practically a partner with Mexico in carrying out the enterprise.

The length of the Tehuantepec route is 112 miles; the estimated cost of the proposed road is $75,000,000. The great advantage of the route over the Panama route—aside from its superior healthfulness—lies in the saving of distance for American shipping and the avoidance of the unfavorable winds and calms of the lower latitudes, the Panama route lying 1,200 miles further south. Ships from New York to San Francisco would save 1,500 miles by way of Tehuantepec; while 2,300 miles are saved over Panama between New Orleans and California.

At Mr. Eads' request an expedition comprising about fifty individuals—engineers, assistants, laborers, and soldiers—to assist him in making a survey of the Isthmus to determine the most practical route for the ship railway, has been prepared by the Mexican Government and sent to the Isthmus. This commission is under the direction of the eminent civil engineer, Francesco De Garay, who is in charge of the drainage of the Valley of Mexico, and who was commissioned to represent the Mexican Government at the Paris Canal Convention. He is directed by the government to assist the engineers of Captain Eads in the instrumental survey of such routes as he may designate. Messrs. Williams and Corthell will direct the survey during the absence of Capt. Eads, who has returned to Washington. It is thought that a large saving in the length of the railway can be made by taking advantage of the Coatzacoalcos River and its tributary, the Usuparapa.

SHOULD A BABY BE FAT?

While there is a measure of truth in the assertion that fat babies are not necessarily healthy, the following much quoted extract from a physician's letter to a Boston paper is likely to do mischief by its extravagant condemnation of fat. Speaking of fatty degeneration the physician says:

"Most infants do become thus diseased before they are three months old. This stops the growth and leaves the poor deceived parents nothing but increase in weight to boast of; and when the poor little victim to his own greed and his parents' folly gets to the end of his tether he melts away like butter in a hot oven, and then it is seen how poor (in flesh) he has been all the time. Few comprehend the broad difference between flesh and fat. The first is lean meat—muscle—the result of growth; while fat—I don't care how hard and solid it may be—is the product or accumulation of unexcretial excess. This is why no one bets a dollar on a fat horse or a fat man—they are 'soft' and 'can't stay.' It is every whit as true of a fat baby. The only wonder is that any infant lives sixty days from birth. Fed before birth but three times a day, he is after birth subjected to ten or twenty meals in the twenty-four hours. Before birth he grows at the rate of about ten pounds per year, after birth he is permitted to fat at the rate of fifty pounds per year until chronic dyspepsia or some acute disease interferes. Feel of a kitten, calf, colt, or a young robin—they are and remain while growing but little more than skin and bones and fur or feathers, because unable to get enough to fatten them, and they never die—rarely have any sort of disease. Children are never fairly 'out of the woods' until they reach the lean age and have pipe-stem legs and arms, with no rolls of fatty tissue anywhere about them. Could they be kept so from birth and not permitted to over-indulge, so that their appetites would always be reliable for plain food, they would have no infantile diseases to enrich our pockets."

Why should the kitten, the colt, or the young robin be taken as a model of infantile health, rather than the puppy, the bear cub, the pig, or the young pigeon?

It is the nature of some young animals to be lean and healthy; of others to be fat and healthy; and there is as marked a difference in the natural tendency of young children. Infants of the same parentage and fed at the same breast will differ in this respect, and both be healthy. Fat laid on at the rate of "fifty pounds a year" is quite another matter, and one not liable, we take it, to be a common cause of anxiety. Injudicious feeding is more apt to show itself in lack of fat, and lack of proper muscular tissue as well. That sort of leanness is much too common in young humanity.

The Value of Weather Prophecies.

Professor Cleveland Abbe, of the Signal Service, was recently interviewed by a Washington correspondent of the Boston *Herald*, who asked the following pertinent questions:

Has the weather bureau paid any official attention to Mr. Vennor's prognostications? A.—To test the accuracy of his work, we have occasionally compared his predictions as published in the newspapers, which accounts, of course, contain telegraphic and typographical errors for which Vennor is not responsible, with the real facts. We find that one-quarter of his predictions are verified, if they are intended for the St. Lawrence valley. If they are meant for this locality, as those who would give him credit for predicting the recent storm here must believe, then not ten per-centum of his prophecies come true. In view of his continued failures, one or two brilliant successes would not justify us in adopting his system of foretelling the weather.

Q.—Upon what are his methods of announcing the weather based? A.—He keeps his system a secret to himself. There are, however, a few ways in which a comparatively truthful guess can be made at the weather months ahead. The first is by observing the average weather during each month for a long period. If we find that, for several months, the average has been wet or cold, it may be predicted that, during the immediate succeeding months, the weather will be the reverse, that is, dry or warm. Then we can get at the matter in another way. When January, February, and March have certain characteristics, the latter part of the year, October, November, and December, will have corresponding characteristics. Thus the weather may be foretold, in a general sense, some months ahead. But no man in the world has ever devised a plan which will foretell special storms on certain days, or which will offer a genuine prediction for a long period in advance. We are sometimes asked to give the weather several days in advance in the case of festival occasions. Under favorable conditions we can do this, with a very good chance of successful prediction. For instance: The chances are that the last few days of August will be clear, because the records show that this is the case five times to one. This, of course, relates to a particular locality, and cannot be made to cover the whole country. I suppose all Mr. Vennor's predictions are made by these methods.

Q.—Have you watched the weather predictions of the New York *Herald*, which are cabled to Europe? A.—Yes, sir. During the first months of that service I very thoroughly and carefully compared their predictions with the weather in Europe, and am satisfied that there is not more than 17 per centum of verifications in the predictions made by the *Herald* bureau. There are about 25 per centum of cases that might be considered doubtful, making a little more than 40 per centum of predictions which come near the truth. A perfectly independent investigation was made by the director of the London meteorological office, and he arrived at precisely the same figure, 41 per centum. This is really no better than could be done by guesswork.

ELECTRIC LIGHT GOOD FOR THE EYES.

When the electric light first began to be used in our shops, factories, and places of amusement, it was confidently asserted by its opponents that so dazzling a light must be injurious to the eye. The objection seemed plausible at least, although the light when diffused seemed to have the quality of bright moonlight, which is the reverse of irritating. People would persist in looking at the source of the light, and as the early lamps were far from steady, the observer's eyes suffered both from the intensity of the light and the sudden and large variations in the quantity of it. It appears, however, from the experiments recently made by Professor Cohn, of Breslau, whose name is so familiar in connection with the investigation of color blindness and other optical defects, that our eyes will be benefited rather than hurt by the new method of lighting, and it is obvious that with incandescent electric lighting the advantages will be still more marked.

While testing the influence of electric light on visual perception and the sense of color, Dr. Cohn proved, he thinks, that letters, spots, and colors were perceived at a much greater distance under electric illumination than by gas light, or even daylight. Compared with daylight, the electric light increased the sensation of yellow sixty fold, red sixfold, and green and blue about twofold. Eyes that in daylight or gaslight could perceive and distinguish colors only with difficulty were much aided by the electric light, and the visual perception was much strengthened. In all cases of distant signaling, Dr. Cohn believes that the electric light will prove exceedingly and especially useful.

William A. Lighthall.

William A. Lighthall, the oldest designer and builder of marine engines in this country, and inventor of the widely used surface condenser for ocean steamers, died in Brooklyn, N. Y., January 4. Mr. Lighthall's connection with steam engineering began with the engines of the Claremont, the first steamer plying on the Hudson River; and for many years he was engaged as superintendent and constructing engineer for river and ocean lines of steamers. He was State Inspector-General of steamboat hulls and boilers in California for three years. From 1847 to 1862 he was inspector of steamboats and boilers in this State. Of late years he has been engaged in the manufacture of surface condensers.

Volcanic Ash for Phylloxera.

It is reported that a Neapolitan gentleman residing at the foot of Mount Vesuvius has cleared his vineyard of phylloxera by the use of volcanic ashes. Seeing that the soil of the country about Vesuvius is largely composed of volcanic ash, it is hard to reconcile the existence of the vine pest there with the alleged inability of the insects to endure its presence.

Charles B. Stewart.

The eminent civil engineer, General Charles B. Stewart, died in Cleveland, Ohio, January 4. General Stewart was engaged in the construction of the Philadelphia, Wilmington, and Baltimore Railroad, one of the first railroads in the country built for passenger service. Subsequently he constructed the Brooklyn dry docks, displaying therein an ability which secured his appointment as Engineer in Chief of the U. S. Navy. His volumes on naval architecture, the construction of dry docks, etc., attracted wide attention at home and abroad, and gained him much distinction at the hands of foreign authorities. He was for one term State engineer of New York, and deserves much, if not most of the credit for the first Niagara suspension bridge. His title was gained during the late war, in command of a regiment and afterwards a brigade of engineers.

BROKEN DIKES IN HOLLAND.—A break in the embankment of the river Maas, between Nieukuik and Vlymen, Holland, December 29, resulted in the submergence of eighteen villages. The whole country called the land of Heusden and Altena was inundated.