the rough, previously cleaned with dilute hydrochloric acid and chloride of zinc, is dipped into a "pit" containing a mixture of melted tin and lead in varying proportions, according to the quality of the goods. The leading firms use no lead for culinary utensils, but only when the article is to be japanned also. Such vessels are generally slop pails, coal scuttles, baths, etc.

The committee commends the suggestion of H. M. Inspector of Factories that the use of lead and arsenic in the enameling and tinning of culinary utensils should be absolutely prohibited.

Washing accommodation, with compulsory use thereof, and prohibition of eating, except in a specially provided room, are to be extended to this industry.

XIV.—REMARKS APPLICABLE TO ALL THE FOREGOING TRADES.

The duty of employers and workers is discussed in relation to the existing and proposed rules, and penalties for contravention are proposed; while the duty of reporting lead poisoning is placed on the same footing as that of reporting accidents. A summary of all the foregoing recommendations and suggestions is given, and after some remarks on the probable effect of these upon the lead industries, the committee record their conviction that lead and all its compounds are more or less poisonous and that the use of each or all of them is attended by danger.

VARNISHING GLASS.

By NELSON K. CHERRILL.

In a recent number of the *Electrician* it is mentioned that Messrs. Siemens & Halske have recently adopted the system of dipping lamps in a thin semi-transparent varnish to obtain the effect of ground glass. As the writer has had much experience in this class of work, a few notes of the best mode of procedure may be of interest. The application of various modifications to the normal appearance of a lamp by means of varnish, either colored or plain, is by no means a novel expedient, and a similar plan has, I believe, been commonly employed in many places for decorative work.

The most important point in the application of varnish to a lamp is to get it to dry just in the right condition. Most kinds of varnish that will dry "bright" under ordinary circumstances will become "matt" if subjected to a chill, or to the action of damp during the drying, and at the same time many varnishes intended to dry with a "matt" surface, that would represent ground glass, dry "bright," if the conditions of drying are not quite suitable.

The class of varnish best adapted to this kind of work is what is known as photographer's negative varnish. This class of varnish dries almost as hard as the glass itself, and when well applied is very durable. When colored lamps are needed, the varnish should be of a quality to dry "bright," but when the effect of ground glass only is required, the simplest way is to use what is known as "retouching" varnish, which gives a "matt" surface at once. In default of this, the ordinary negative varnish can be easily modified to give the desired surface by the addition of a little weaker alcohol, which almost always has the desired effect; but if there is any difficulty, a little common resin, which chills very easily in drying, may be added to the varnish.

As to the mode of applying the varnish to the lamps, the best plan is to hang them on a frame by their contacts, so that a current can be passed through them during the operation. The lamps should be well washed in warm water, in which there has been dissolved a liberal dose of soda. A thorough rinse with fresh cold water should be given, and the bulbs should then be carefully wiped quite dry with clean linen rags. If the work is to be very nicely done, the operator who hangs up the lamps on the screen should have on linen gloves, as finger marks on the glass are apt to show when the whole process is finished. The varnish is poured into an upright glass vessel large enough to contain the lamp. A common drinking glass is as good as anything, if large enough to admit the lamp. In pouring out the varnish, care should be taken not to disturb any sediment which may be at the bottom, and if not quite clear it should be filtered, as it is of the greatest importance to avoid any small floating particles, which would cause spots or streaks on the finished surface.

All being ready, if the varnish is to dry bright, *i. e.*, for colored lamps, etc., switch on the current to the lamp for a few moments, so as to render it slightly warm. Then turn it off, and taking the glass of varnish in the left hand, raise it under the lamp until the whole globe is immersed. If the lamp is in any kind of rigid fitting, it will be very easy to immerse it, but if it is merely hung on a couple of wires, it will require the aid of a little instrument, consisting of a forked piece of wood, to push the globe down into the varnish. As soon as the varnish entirely covers the globe, lower the glass with one steady movement, so that the draining off the superfluous varnish shall be commenced in one even wave all over the globe. Any hesitation or pausing in the motion of the glass will be almost sure to cause a line on the finished lamp.

As soon as the tumbler of varnish is quite clear from the lamp, turn on the current again, and leave it running, while several more lamps are being done. When about twelve lamps have been varnished, the first will be ready to come off. But a little care must be taken till the lamp is quite cold, as some varnishes will finger mark readily at this stage. If the varnish is to dry "matt," the lamp should be plunged quite cold, and no current should be put into the lamp till the varnish has chilled all over, then a little warmth will aid the drying, and will also harden the varnish. Almost any color can be given to the varnish by the simple use of Judson's dyes, which will readily mix with the varnish and impart their characteristic tints.

Blue is the most difficult color to arrive at satisfactorily, as the dye does not seem to blend so well with the varnish as the other colors, and, besides, the color is spoiled by the yellow tone of the light. To avoid this part of the difficulty, the lamps which are to be used blue should be run as hot as possible, while those for red or yellow colors may be comparatively cool, the yellow especially so.

It goes without saying that all the testing of the

lamps must be finished before the varnishing is commenced.

A pleasing effect is sometimes produced for purely decorative work by using a little dye with the "matt" varnish.

ALEXANDER SIEMENS.

MR. ALEXANDER SIEMENS, whose portrait we publish this week, was born, says *The Electrician*, at Hanover in 1847, and was educated at the Lyceum and Polytechnic College there. In 1867 he came to England, and worked for a short time at the telegraph factory of Messrs. Siemens Brothers, at Woolwich. In the following year he went to Berlin to study at the university, and remained there until 1870, with the exception of filling a temporary engagement, during which he assisted in constructing the Indo-European telegraph line from the Persian frontier to Teheran and in laying the Black Sea cables at Kertch and from Sukhum Kale to Socha. He was next called upon to serve his country in the Franco-German war, and was present at the siege of Metz, and afterward, under Prince Frederick Charles, joined in the operations against Orleans. He was wounded at the battle of Beaune la Rolande, and for his distinguished services in the field received the Iron Cross.

At the conclusion of the war Mr. Siemens was able to continue his scientific studies, and coming to England became a pupil of the late Sir William Siemens. In 1873-74 he was conducting experiments for Sir William, at Birmingham, with a rotary furnace to produce wrought iron and steel direct from the ore. In 1875 Mr. Siemens joined the cable ship *Faraday* and took part in several cable laying and repairing expeditions. While the ship was stationed at Halifax, N. S., he built some blast furnaces at Londonderry, N. S., for the Steel Company of Canada, and superintended the erection of a rotary furnace at Pittsburg, Pa. Returning to England in 1877, he was employed in erecting regenerative gas furnaces for various purposes in different parts of England, among them being the first continuous working tank glass furnace erected in this country. In 1879 he became actively engaged in electrical work for Messrs. Siemens Brothers, and had to

ALEXANDER SIEMENS.

do with some of the first electric light installations, such as those at the Albert Hall, the British Museum, the Albert Docks and the Blackpool Promenade. He also laid down an electric light plant at Godalming, the first town in England to so light all its thoroughfares and supply current to private consumers.

Mr. Alexander Siemens became a director of Siemens Brothers & Co. some time ago, and is now the only director residing permanently in England. In 1892 he contributed a paper to section G of the British Association at Edinburgh, on "Electric Locomotives on the City and South London Railway." He has been for many years a member of the Institution of Electrical Engineers, to which body he has contributed several papers of great interest to the profession, the most recent being that read on February 11, 1892, upon "Some Experimental Investigations of Alternate Currents." He was elected a vice president of the Institution four years ago, and is president for the year 1894.

STORAGE BATTERY TRACTION AT WASHINGTON, D. C.*

By GEORGE C. MAYNARD.

STORAGE batteries have been weighed in the balance and found—too heavy. An honest man held the scales. Geo. W. Pearson is one of the best all-round street railway men in the United States. For nine years he has been president and active manager of the Metropolitan Railway, in Washington, D. C. During that period the necessity and the possibility of procuring a substitute for horse power for the propulsion of street cars has been one of the most important and pressing subjects he has had to consider, and he has given it the most careful and thorough study. Every known method has been investigated. These investigations led Mr. Pearson to a belief in the truth which everybody realizes and all disinterested persons admit, that the ideal motor is one which will make every car independent of all the others.

The Metropolitan Railroad (not counting several

branches) is a double track road five and one-half miles long. It begins on the hills above Georgetown and ends in the eastern section of the city, a mile beyond the capitol. It runs through the principal business and residence sections of the city and passes the capitol and eight of the principal government buildings. The travel on the line is irregular, and at times exceedingly heavy. There is not a hundred feet of level track in the whole road. The grades range from two and one-half to five per cent., and there are forty-two curves, many of them very sharp. The sharpest curves are on the heaviest grades.

The use of a cable under such conditions was manifestly impracticable; the trolley system was prohibited by public opinion and a law of Congress; steam was out of the question; the proposition to use compressed air was an intangible scheme. On March 5, 1889, a special act of Congress declared that the use of horses should cease two years thereafter.

These facts pointed to storage batteries as most likely to furnish available power. Out of ten chaotic years of bitter contests and wasteful litigation over the rights of rival claimants to the invention, there came fair prospect of commercial utility backed by strong assurances from men of good judgment and sincere purpose. Some of the most competent electrical engineers in the country unhesitatingly declared their conviction that street railways could be successfully and economically operated by this system.

In the summer of 1889 Mr. Pearson and his associates determined not to add one more to the long list of trifling experiments, but to operate their road with storage battery cars if it were possible. At the outset they engaged the services of the well known electrical engineer, Mr. C. O. Mailloux, of New York, who had made a special study of accumulators ever since their introduction, to design a suitable plant and superintend its construction and operation. With him came Mr. F. H. Chamberlain, a practical electrical expert who had had a long and varied experience in work of this character. He has had charge of the Metropolitan power house and all the details of the work during the entire time it has been going on.

In the course of four months after the undertaking was started the first car was put on the road. Experimental trips were made at night after the day's traffic was done. With a fair load of the company's officers and directors a speed of 15 miles an hour over the whole line was attained and the prospects of success brightened. Additional cars were equipped, and, early in 1890, several were put on the road for regular service, sandwiched between horse cars and running at a uniform rate not exceeding six miles an hour. The fact that they were limited to this slow speed when they could easily go much faster was a trial to the ambitious motormen, who were disposed to regard their position as quite superior to that of the car horse drivers. Passengers patronized the new cars and the public watched their progress with much interest. Popular opinion turned in their favor, and for a while there was frequent expression of the opinion that the problem of rapid transit in large cities was solved. Still the months ran on into years and the horse cars were not displaced. Then there began to be surmises that the Metropolitan Company was only trying to gain time by making a show of changing its system, and did not really intend to make the use of storage battery motors permanent, even if the scheme proved feasible. As time went on the motors began to show signs of weakness, being frequently seen slowly laboring up the grades with a long line of horse cars behind them, and now and then blocking the road with a flat refusal to move another foot. In such cases their excessive weight precluding the possibility of removing them from the rails, the horse cars were jumped around them until relief could be obtained, when the proud-spirited motorman was compelled to resign his command to a plebeian driver, and four of the strongest horses from the stable would ignominiously drag the lumbering old ark back to the seclusion of the power house. As many as four cars were stalled at one time. But this was not altogether discouraging, for while the result of the trial of the first storage battery was not successful, the respective promoters of nearly a dozen other schemes stood ready to guarantee that their batteries would do the work. Every one of these was given an opportunity to demonstrate the truth of their claims, and nine different styles of accumulators were tested. The company provided every facility for charging and operating the batteries, and allowed the experts of each company to personally supervise the operations and to show what they could do.

An inspection of the Metropolitan Company's power house and facilities for operating the battery cars clearly evidences the seriousness and determination with which Mr. Pearson undertook the work. The buildings are substantial, spacious structures, erected especially for the work. The boiler house is 50×60 feet and contains three Campbell & Zell's 200 horse power boilers set with Murphy's mechanical stokers and provided with appliances of the most approved and efficient character. The engine and dynamo room is 65×85 feet. There are three Wright tandem compound non-condensing engines of 230 horse power each in place, with foundations laid for a fourth engine of the same size. The principal dynamos are Thomson-Houston 160 kilowatt machines, capable of developing a current of 220 volts and 800 amperes, and a number of auxiliary machines provided with ingenious appliances for coupling them in various combinations afford facilities for supplying any desired current. The station is equipped with an exceedingly complete outfit of the best Weston testing and measuring instruments.

The battery house is 85×122 feet, two stories high. The floors are built of cement, laid on heavy iron supports, and are thoroughly acid proof. The arrangements for convenient and rapid handling of the batteries are most complete. This building faces the street along which the main track runs, while the engine and boiler houses are in the rear. By a loop from the main track the cars are run through the building, stopping on a platform, on each side of which is an elevator operated by two Thomson-Houston 15 horse power motors. The batteries arranged in racks, after being charged in the upper story of the building, are lowered to the side of the car, where the exhausted cells are quickly

* *The Electrician* Review, New York.