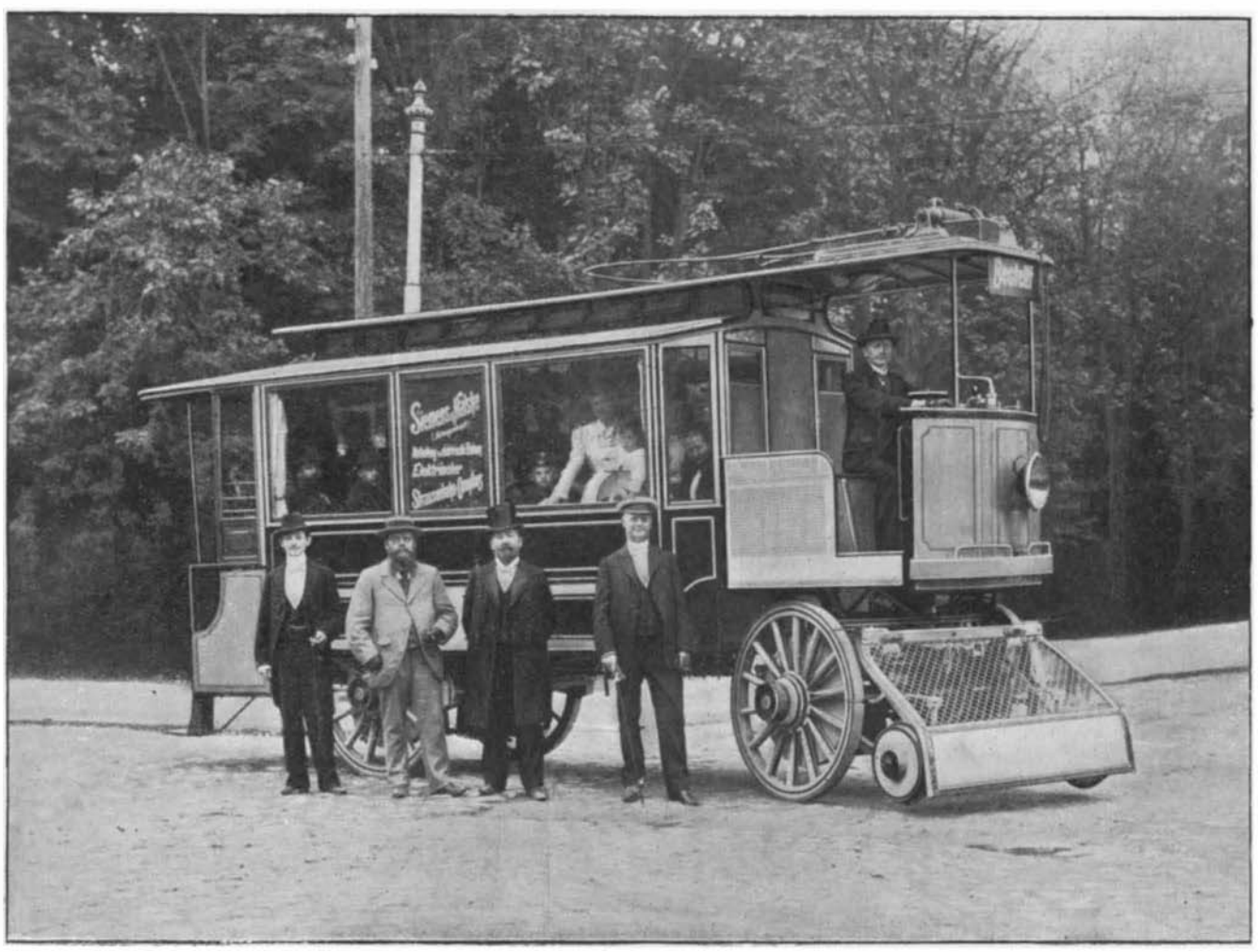
only as an illustration of the method. The dimensions of the various parts of the eclipse can be made with accuracy by estimating them in terms of the moon's diameter as a convenient unit. The party should practice together beforehand, each sketching only his proper quadrant from a corona drawing suspended at the angular height of the sun. The time of exposure of drawing should be slightly less than the known duration of the eclipse. White chalk on purplish blue paper gives admirable results. On eclipse day the sketchers should avoid fatiguing their eyes by too much observation of the preceding partial eclipse and should rest the eyes for the last five minutes before absolute totality.

Photographs of the corona are of great scientific value, and may be obtained with instruments of moderate dimensions. Almost any good rectilinear lens may be used. One with an aperture of 2⅛ inches and of a focal length of 32½ inches proved very satisfactory in the Indian eclipse expedition of 1898. For plates of ordinary sensitiveness exposures of one or two seconds are ample. It is better to use a plate of normal sensitiveness instead of an extra rapid one, and to lengthen the exposure in proportion, because a slower plate is easier to handle and permits of a more restricted and prolonged development and is less liable to accidental fogging. Photographs taken with amateur instruments are, of course, not as valuable as those taken with instruments provided with a driving clock or other device for keeping the image stationary on the plate. In focusing, the instrument should be pointed at a well-defined object distant say from one-quarter of a mile to a mile, and the object brought to a short focus for center plate. The image of the sun is really a small object and occupies but a comparatively small part of the center of the field. The focal length of the camera in inches will give roughly the diameter of the sun's image in hundredths of an inch. Negatives should not be retouched.

While a proper telescope is desirable, small spy-glasses and opera glasses may be used. For the first and last contact shade glasses are necessary. The usual and most objectionable color for a shade is red, either a neutral tint or green should be used, and deep blue is also recommended. Instruments specially intended for observing the sun are always provided with arrangements for getting rid of the excessive light and heat without diminishing the aperture, and often without using shades. Special care must be taken that the temperature of the tube is the same as that of the outside air. The first contact is a slight indentation in the sun's limb, and it usually attains some size before the observer, unless he is specially trained, sees it. The internal contacts, or beginning and end of totality, are phenomena of such a definite character that the instant of their occurrence can be noted within a small fraction of a second. For a minute or two before the predicted time of second contact the sun's thin and now fast-waning crescent should be carefully watched through a neutral or green shade glass. Presently the crescent will become a mere thread of light, which will rapidly shorten and suddenly disappear. The approach of the third contact will be heralded by the rapid brightening of the chromosphere at the point of the moon's limb, where the sun is about to reappear, and two or three seconds later a sudden burst of light will announce the contact itself, and with it the termination of totality. The observation of the fourth contact is a simple matter. The segment cut out of the sun by the retreating limb of the moon is carefully watched as it becomes less and less, and the instant of its final disappearance is noted as the fourth contact. Very precise directions are given by the Naval Observatory authorities for amateur telescopic observing parties, and are sent by them on request.

In our chart the shadow path is crossed at more or less uniform intervals by straight dotted lines which terminate in the north and south limits of totality. Each of these lines is approximately the locus of all points for which the middle of total eclipse occurs at the moment of Greenwich mean time indicated thereon. The adopted interval is five minutes. The longer dotted lines include points for each. Either the beginning or ending of partial eclipse will occur at the moment indicated.

SIEMENS AND HALSKE OMNIBUS DRIVEN BY OVERHEAD CURRENT.



THE SIEMENS AND HALSKE OMNIBUS DRIVEN BY ACCUMULATOR.

A COMBINED AUTOMOBILE AND TRAMWAY OMNIBUS.

A vehicle of a very novel form, designed by the well-known German firm of Siemens and Halske, has been used with considerable success in the city of Berlin. The vehicle is an electrically-driven omnibus which differs from other electromobiles in so far as it derives its power both from accumulators and from two overhead trolley wires, so that it can travel in streets without tracks as well as upon the rails of a tramway.

The omnibus, since it can be used with or without tracks, is admirably adapted to connect all parts of the city with one another. For it can travel, not only in those streets too narrow to permit the laying of tracks, but also in the restricted avenues in which the laying of rails is prohibited.

When the omnibus runs upon the tracks of an electric line, it takes the current necessary to actuate its motors and to charge its accumulators from the feed-wire above; but when it travels in rail-less streets, the conducting loop and its carrier are lowered, and the current from the accumulators is used.

The vehicle possesses the advantages over electric automobiles hitherto constructed of employing lighter accumulators and using a smaller amount of current when running on tracks, owing to the slight resistance. Moreover a high speed is attained,

and unnecessary long stops for charging the battery avoided.

In its external appearance the vehicle differs from the usual horse-drawn omnibus in the smaller width between the rear wheels (rendered necessary by the gage of the tracks) and in the arrangement of the front wheels, which are mounted directly beneath the driver's platform. In advance of the front wheels a small truck is arranged, carrying two small, flanged bogie-wheels, which can be raised and lowered, and which serve the purpose of guiding the omnibus when running on rails. Directly over the front axle, on the roof of the vehicle, is the loop peculiar to Siemens and Halske electric cars, serving the purpose of conducting the overhead current to the motor and battery.

The fifth-wheel of the omnibus, mounted on balls, can be turned through such an angle that the wheels of the front truck are at right angles to the longitudinal axis of the vehicle. By reason of this arrangement the sharp corners of very narrow streets can be easily rounded.

The brakes consist of one friction brake for the rear wheels, and an electric short-circuit brake connected with all four wheels and operated by the same switch-handle used in starting the vehicle.

The four wheels are each provided with a motor. The storage battery by which these motors are driven consists of 200 cells.

In certain streets of the city of Berlin the installment of overhead wires is permitted, but the laying of tracks prohibited. Under these circumstances, slight modifications in the construction of the omnibus must be made. The accumulator and bogie-truck are discarded. The omnibus derives its power from the overhead current, two wires being necessarily provided, one to feed and the other to return the current.

At a public test made before the city authorities, the Siemens and Halske omnibus attained a speed of 25 kilometers per hour (16 miles).

Hollow Glass Vessels.

Hitherto it has not been possible to obtain glass vessels of large capacity for chemical purposes owing to the fact that the masses are too heavy to be handled by the blowers. In a new German process the glass is ladled out and poured on an iron table with an adjustable framework. The table plate is hollow and communicates by a number of perforations with a compressed air cylinder. A groove of suitable shape is provided on the plate. This groove is filled with glass and covered in afterwards so as to act as a support for the glass when the plate is turned over. When this is done the glass begins to separate from the iron plate and to bulge out. The admission of compressed air hastens the process. When a glass kettle is to be formed a circular groove is used and molds may be applied at the same time. Imitation crystal vessels are made in the same way, says The Trade Journals' Review, the start being made with the glass plate as before. A sheet of asbestos paper impregnated with water is then applied to it. The two are then taken from the iron table and the respective mold is fixed over the glass surface, cutting off a slab of the proper size. The asbestos begins to steam and the vapor forces the glass into the mold. The process works quickly and gives beautiful results. To produce a colored pattern on the glass, the design is made on thin paper and powdered glass is used as a coloring matter. The glass side is applied to the hot vessel, the paper is burnt in an instant and the colored pattern fixed in the glass. The new process also affords advantages for plate glass manufacture.

Sandglasses.

Strange to say the sandglass is still used to measure varying periods of time. The size depends upon the purposes to which they are to be put. The hour glass is still in use in the sickroom and in the music room, in both places affording a sure and silent indication of the progress of time. Half-hour glasses are used in schools, and fifteen minute glasses are used for medical purposes, and the sandglass also goes into the kitchen as an aid to exact cooking. There are also ten minute glasses, five minute glasses and three minute glasses, the two latter being used to time the boiling period of eggs. The three minute sandglass is called an "egg boiler." Sandglasses, says The New York Sun, are also used for scientific purposes and on shipboard, being more convenient than holding a watch.

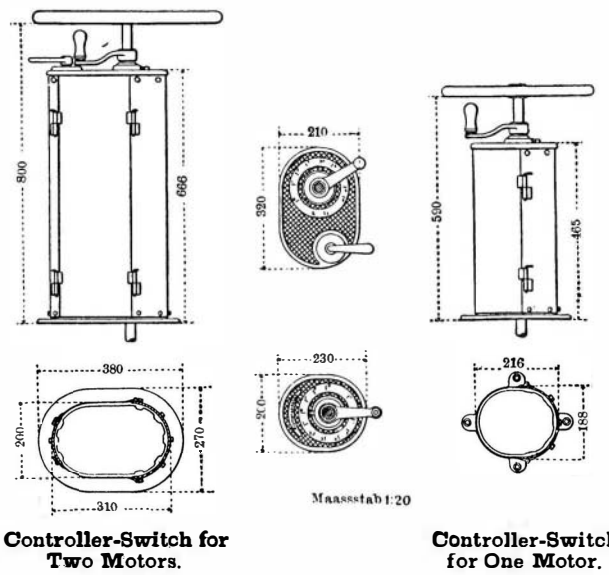
They are made in this country and are also imported from abroad. The sand is carefully prepared by a thorough cleaning, including boiling. It is then baked dry and then ground into the requisite fineness and uniformity, as sharp sand would be likely to become wedged in the opening between the two sections of the glass. The sand is then introduced into the glass through an opening left for that purpose in the end of one bulb, the opening then being sealed, the right quantity in each sand glass is gaged by actually timing the flow from one part of the glass to the other, and every glass is individually treated like a good thermometer. The glasses are usually mounted in cylindrical frames or holders so that the twin bulbs can be seen at all times. The type usually sold is that represented in pictures of Father Time. The outer glass appears very large to those who have never seen one standing 6 or 7 inches high, but this seemingly large size is necessary in order to accommodate a considerable quantity of sand.

The Turquois Mines of Persia.

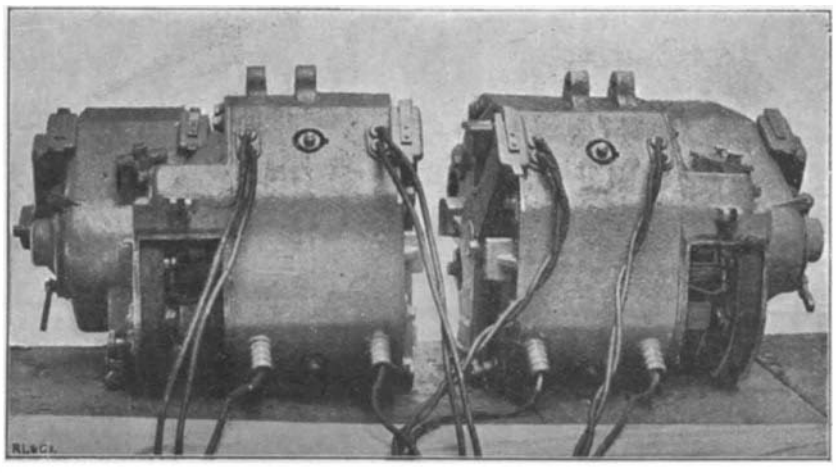
About thirty-five miles from Nishapour in the Khorassan are the celebrated turquois mines of Persia. The only mines in the world producing this fashionable stone. They are situated in a mountainous region 5,000 or 6,000 feet above sea level and employ perhaps 1,500 persons. The concession is about 40 square miles in extent, including a few villages, the turquois, salt and other mines.

This tract is exploited by a local chief and banker in partnership who pay an annual rental of 14,000 tomaus or $14,000. The lessees work only three mines, the "Reish," the "Zaki" and the "Ali Merzai" and sublet twelve others.

On approaching from Nishapour one ascends gradually among low hills until within 1,000 feet of the summit of the range. All of the mines being on the southern face of this last eminence. The slope is deeply cut by ravines and to go from one mine to another necessitates some hard climbing.



Controller-Switch for Two Motors. Controller-Switch for One Motor.



7½ H. P. MOTORS, 1,000 REVOLUTIONS. WEIGHT, 330 KG. (726 POUNDS).

The underground mines are opened in the solid rock by picks and by blasting. There are also Khaki (earth) mines or surface diggings in the débris of the mines, or in the detrictus of the rocks washed down by the rains and extending a mile or so over the plain from the foot of the mountain. In former times the mines appear to have been well worked. Remains of vertical shafts for lighting and ventilation are to be seen, while entrance was evidently had by means of galleries running in on the side of the mountain.

When the Safavian dynasty came to an end, about the first quarter of the last century, the villagers began to farm the mines and, in order to save time and labor, cut away the supports in the mines wherever a gem was found so that many, the Maliki, Zaki and Mirza Ahmedi among them, caved in.

The ancient Zaki mine was of considerable depth. The bottom of the present working is 120 feet beneath the surface but as yet no signs of the old mine appear. Several attempts along this line have been made. Owing, however, to lack of funds or energy they were abandoned.

About 100 miners are employed at the three mines mentioned, receiving from 2 to 3 krans per day. (A kran equals ten cents.)

The Reish is the only mine in full operation, if entire lack of methods and rational work can be so termed. The lessees only desiring to recoup their outlay. It produces the greater part of the world's supply of turquois, having a weekly output of over $400.

A cave, 36 feet across, serves for the entrance of this mine from which a shaft of about 15 feet in diameter descends.

The manner of working is primitive in the extreme. Two men sitting at the opening of the shaft, their backs braced against the cave wall, turn an old wooden wheel with their feet. From the wheel depends a small sheepskin bag capable of holding perhaps a peck. A third man received the full bag, empties and reattaches it to the rope. The wheel is suddenly released and the bag drops to a depth of 40 feet where other workmen on a narrow ledge repeat the process. The total depth of the mine being from 80 to 90 feet.

The miners descend to their work a portion of the distance through a diagonal tunnel piercing the shaft. From this point they scramble down the rough shaft. On a narrow shelf of rock near the mouth of the cave workmen break the fragments of rock with small hammers. The stones when found are put aside to be sent to Meshed in the rough state.

The débris from the mine is sifted over by boys perched on other ledges. This mine is very productive, but the stones are not of first-class quality.

Many mine openings are mere burrows, barely large enough to admit a man. Such is the case with the Abdar Rezai which formerly produced the finest stones in the world, of deep sky-blue color and unfading luster. Some years ago it caved in and now few first-class stones are found. The work in the Khaki mines is usually done by women and children who simply dig up and look over the earth. They find, perhaps, half a dozen turquois a day. Even the poorest stones are prized by the Orientals who wear them set in tin rings. Motley green spotted stones with but a thin coating of enamel, sometimes cracked and showing the brown inside core, will now be purchased by the Arabs. Defective flat gems are utilized by inscribing upon them words or mottos in gold in such a way as to hide the imperfections. Every species of stone finds a sale. The smallest being used in ornamental brass work and for decorating pipes.

Good stones could probably still be discovered, if systematic mining were carried on. The soil seems to be full of turquois in different stages of development from a cream colored chalky substance, which is said to possess medicinal qualities and is eaten by the natives, through intermediate forms of hard chalk to the variously shaded green and blue gems. The approach to the mines is literally strewn with fragments of the stones, and the walls and ceilings of the galleries are seamed with turquois composition, but being of bad color and full of flaws it is valueless. Some stones may seem to be of good quality, but they soon fade or white spots appear. These spots can be seen, at first, only with a glass. In time they increase in size and finally spread across the stone.

If a faded turquois be dampened its color is temporarily restored. The natives utilize this quality by carrying a stone in their mouths and deftly slipping it into their hands to display it. Dealers in Meshed guard against such deceptions by retaining a stone a few days before purchasing as the turquois is the most treacherous of jewels.

High prices are now paid for stones in Meshed. Indeed, good gems can be bought more cheaply at Tiflis or Constantinople. Some few years ago five turquois of cerulean blue, perfect shape, good size and flawless, could be bought for a dollar or so in Meshed, but, at present, as soon as cut they are exported direct to Moscow to supply Russian nobles or are sold to wealthy Persians. Those sold at Teheran by pilgrims returning from Meshed are of very ordinary quality.

H. L. Geissel.

Arizona's Petrified Forest to be Protected.

The chairman of the House Committee on Public Lands, Mr. Lacey, of Iowa, is advocating the project of setting aside a certain tract of land in Arizona as a petrified forest national park. This forest is one of the greatest natural curiosities on the American continent, and if properly cared for it will almost rival in interest the wonders of the Yellowstone, the Yosemite and the Mount Rainier Reservations. The petrified park lies a short distance from the Grand Canyon of the Colorado in Apache County. The trees probably grew beside some inland sea. After falling the cell structure of the wood in the tree was entirely replaced by silica. One of the most remarkable features of the park is a natural bridge 45 feet in width which spans the canyon; nearly 50 feet of the tree lies on one side so it is visible for nearly 100 feet. The wood is very handsome when polished.