

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 installation 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

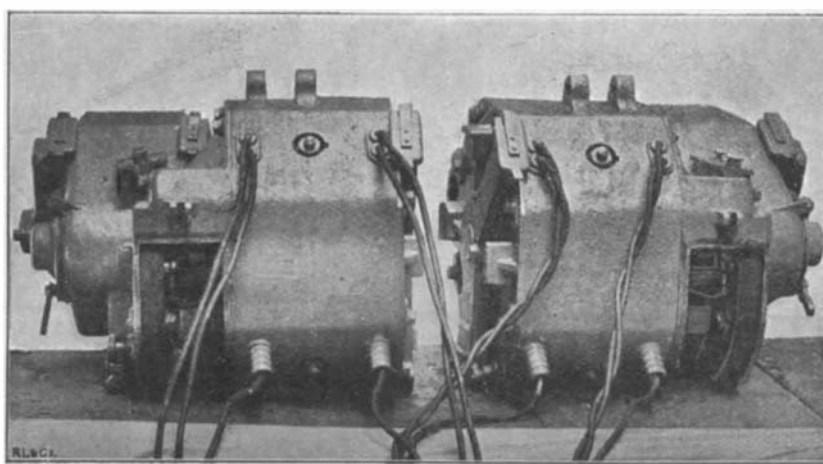
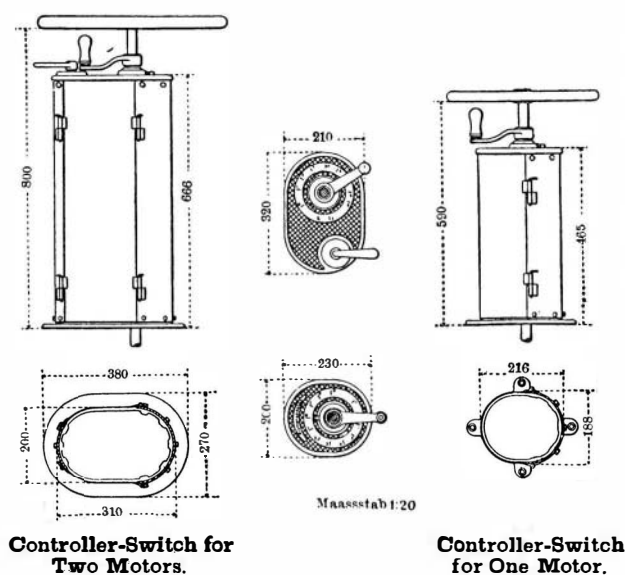
through an opening left for that purpose in the end of one bulb, the opening then being sealed, the right quantity in each sand glass is gaged by actually timing the flow from one part of the glass to the other, and every glass is individually treated like a good thermometer. The glasses are usually 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 Khorasan are the celebrated turquoise 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 turquoise, salt and other mines.

This tract is exploited by a local chief and banker in partnership who pay an annual rental of 14,000 tomas 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 sum-



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

mit 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.

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 debris of the mines, or in the detritus 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 turquoise, 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 debris 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 turquoise 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 turquoise 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 turquoise 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 turquoise 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 turquoise 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 turquoises 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.

Science Notes.

By this time Lieut. Peary has probably left his winter quarters and started on his trip to the Pole.

In restoring the White House recently while the workmen were painting the doors they discovered that they were of solid mahogany, but owing to some mistake the original wood had been painted in imitation of walnut. The paint was at once scraped off and the doors restored to their pristine state.

Prof. Dewar found by using a rhodium-platinum resistance thermometer, and by the use of methods designed to overcome the difficulties arising from the presence of air in the hydrogen, that the boiling point was 246°C . A constant volume hydrogen thermometer working under diminished pressure gave 252°C . The pure platinum resistance thermometer gave 238°C .

A bill passed by the New Jersey Legislature on March 20, authorizes the appointment by the Governor of a committee of ten persons to be known as the Commissioners of the Palisades. These Commissioners shall have power to condemn lands and take all other steps necessary for the preservation of the tall cliffs, and the subsequent conversion of the lands into a park in conjunction with the authorities of New York State.

Crude petroleum is said to be a remedy which will destroy and prevent the germination of the San Jose scale. It is said that it not only destroys this pernicious insect, but it also stimulates the growth of the tree to which it is applied. It is thought, however, by the best authorities that the scale can only be eradicated by destroying the tree infested with the bug and petroleum baths are apt to be fatal to trees.

P. Bourcet has experimented with certain edible plants with the object of determining how they absorb the iodine they require, and he publishes a table which shows that under identical conditions of soil, moisture and exposure, some plants absorb much more iodine than others, while some do not absorb a trace. The *Liliaceæ* and *Chenopodiaceæ* were found to accumulate much more iodine than the *Solanaceæ* or the *Umbelliferae*. In the case of the *Compositæ* and *Cruciferae* the absorption of iodine varies in different species.

A German physician states that the wearing of veils is the cause of acne rosacea affecting the nose and he relates a number of instances in which young women, who were otherwise in excellent health, had their complexions impaired by wearing veils when riding, cycling, etc. He considers that the lesion is caused by the friction of the skin against the veil, impregnated with moisture from the breath, the effect being exaggerated by the tightness with which it is necessary to attach the veil when indulging in athletic pursuits. If veils must be worn while taking exercise, they should be loose, and the nose should be annointed with lanoline or some other suitable lubricant.

The investigations which have been carried on by the Connecticut Agricultural Experiment Stations on food adulteration shows that samples of ground coffee show a decrease in adulteration during the last four years, from 89 per cent to about 19 per cent. Fifty-six out of ninety-two samples of soda water sirups were found adulterated. The fruit juices, all samples, five in number, were adulterated, and the bottled sirups fifteen out of twenty-three samples were adulterated. Out of the ninety samples of bottled carbonated drinks, thirty-three were adulterated. The chief agents were boracic and salicylic acids and coal-tar dyes. In the sirup of a single glass of soda water was found enough dye to color brilliantly a piece of white woolen cloth, 6 inches square. The artificial extracts used in coloring are often of a nature to produce indigestion. Oysters and milk were also found to be kept by the aid of preservatives. The worst feature of the matter is that these foods are often prescribed for people who have feeble digestions.

Dr. A. MacFadyen finds that bacteria may be kept at a temperature of -190°C . for twenty hours without their vital powers being affected. The organism with which he experimented possessed varying degrees of resistance to external agents—the extremes being represented by the very sensitive spirillum of cholera asiatica, and the highly resistant spores of the anthrax bacillus. Pure cultures were taken of bacillus typhosus, *B. coli communis*, *B. diphtheria*, *S. cholera asiatica*, *B. proteus vulgaris*, *B. acidilactici*, *B. anthracis* (sporing culture), *staphylococcus pyogenes aureus*, *B. phosphorescens*, and *photobacterium balticum*. They were simultaneously exposed to the temperature of liquid air (-182°C . to -190°C .) for twenty hours, then carefully thawed and examined. In no instance could any impairment of vitality be detected, the fresh growth obtained being normal in every respect, and the functional activities of the bacteria quite unaffected. Experiments with representative types of organisms usually met with in the air—molds, bacilli, cocci, torulae, and sarcinae—had similar results, while a sample of yeast cell plasma (Buchner's zymase) retained its peculiar properties unchanged as regards the production of carbon dioxide and alcohol, after twenty hours' exposure to the intense cold mentioned. —Lancet.

Engineering Notes.

The rails on the railroads of India have been gradually increased in weight. Those used on the Indian Southern Railway now weigh 75 pounds; those of the East Indian Railway, 85 pounds; the length of the rails has been increased from 24 to 30 feet, and on one railroad 40 feet.

The Chicago Midlothian Club, of Chicago, is to build a railroad from the terminus of the street car tracks in Blue Island to the Midlothian clubhouse, a distance of five miles. Gasoline will probably be used to propel the cars. This is probably the first railroad built for the use of those interested in golf.

The annual report of the Boston Transit Commission was issued January 25 and gives some interesting comparisons. In 1897 the utmost capacity of the surface tracks in Tremont Street was 200 cars each way, per hour, and the rate of progress was sometimes as low as 2 miles per hour. In October, 1898, the subway, during the hours of the heaviest traffic, transmitted 282 cars each way per hour, the speed including stops being seven to eight miles per hour. It is estimated that the subway can carry 50,000,000 passengers per year.

Experiments were some time ago carried out by MM. Barthelot and le Chatelier to ascertain the velocity of detonation of acetylene, says The Engineer. The gas was exploded in horizontal glass tubes about 1 m. long and of 2 mm. to 6 mm. in diameter, and was operated with at various pressures between 5 and 30 kilo. per sq. cm. The velocity was registered by a falling photographic apparatus, released at the moment of detonation. The image of the horizontally-moving flame in the tube, combined with this vertical movement, gave a curve on the photograph, from which at any point the velocity could be found. The results indicate that the velocity depends upon the initial pressure of the gas, from about 1,000 m. per second at 5 kilos per sq. cm. to 1,600 m. at 30 kilos.

With the object, says The Globe, of encouraging emigration to the fertile regions recently opened up by the Trans-Siberian Railway, the Russian government have given orders for the issue of tickets at a very cheap rate. These special tickets will be issued for Tobolsk, Irkutsk, and, beyond there, for Vladivostok and Port Arthur. One ticket, apparently, will cover a whole family, and will be available at something like 114 stations on the line of route. The zone tariff has been adopted. From any point in Russian Europe to Tobolsk the price per head has been fixed at two roubles. Beyond Tobolsk to any spot in the vast Siberian region the charge for these emigrant tickets will be $4\frac{1}{2}$ roubles a head—that is to say, that for about \$3.62, one will be able to travel a distance of over 6,000 kiloms., or something like 4,000 miles.

A historical collection relating to the subject of transportation, vehicles, etc., is to be established in the Civil Engineering Palace of the Paris Exposition, which promises to be of considerable interest, as the principal railroad companies have announced their intention of contributing objects of interest relating to this subject. The collection will contain a number of diligences and other vehicles, such as have been used in France in past years, and also various types of velocipedes, and other objects which concern the history of travel or locomotion. The committee in charge of the matter has issued an appeal to all persons who are in possession of interesting objects, drawings, engravings, medals, articles of voyage, etc., asking their co-operation in making up this collection. All articles sent will be guaranteed from risk by the Administration of the Exposition. Communications upon this subject may be addressed to M. Duchemin, 12 Rue de Hambourg, Paris.

The Italian Navy has recently added a new torpedo cruiser, called the "Agordat;" it was launched on the 12th of last October. This boat has a length of 87 meters and a maximum width of 9.3 meters. The average draught is 3.2 meters and the displacement 1,350 tons. The protection of the "Agordat" is assured by an armored deck inclined on all sides and extending the whole length of the boat. This deck has in the central part an armor of 10 millimeters, which is doubled on the sides, over a length equal to about half the boat. The protection is completed by the coal bunkers, which contains about 160 tons; these are placed forward and arranged above and below the armored deck. The engines are designed to give 8,000 horse power normally, at a speed of 23 knots per hour; of these there are two of the triple expansion type with four cylinders. Water tube boilers of the Bleck-ynden type are used; these having four fire-places. These boilers are placed in two compartments, situated forward and aft of the engine room. The armament consists of 12 cannon of 76 millimeters; two of these are placed forward and two aft, with a range of 150° from the keel-line. Six of the guns are placed on the sides, with a range of 120°, and the remaining two under the forecastle, with 150° range. The vessel is provided with two torpedo tubes placed on deck in the center of the boat.

Electrical Notes.

The peculiar value of electrical power for the operation of the mountain railroads is now becoming recognized. It is probable that soon the trolley system will be the only one used for mountain climbing, thus effecting the saving of the weight of locomotives, water and fuel. The overhead trolley has been adopted for the Jungfrau, and a similar system will be used on the projected rack railway between Chamounix and the Montanvert.

The St. Louis and Suburban Railway Company have advanced the salaries of all their employees 10 per cent for the two weeks of February on account of the hardships entailed by bad weather, and the good work which they did. The St. Louis Transport Company has also granted its employees extra pay for work done in February. Each employee received 75 cents for work on the night of the storm of February 28 says The Street Railway Journal.

The relative actinic intensities of the three parts of the electric arc—viz, (a) a green tinted aureole, b (a) darker mantle of flame, and (c) a bright blue-violet nucleus—depend greatly upon the kind of carbons used. Experiments have been carried out by Herr E. W. L. Richter in which a Nicol's prism photometer is employed for comparing the apparent relative intensities, using in some cases carbons with a known percentage of a salt, such as sodic chloride. In one case mentioned, using solid carbons 13 mm. diameter with an arc length 15 amperes, and 56 volts, the ratios are $b:a:c = 1:2.28:3.32$.

Single tracks are largely used in India and South America and in India the large wheel is used at the end of the outrigger, and the load is so distributed that the weight is chiefly carried by the rail-wheels, but are slightly overbalanced on the side of the road-wheel. A Scotch firm has recently devised a single rail truck for use in India. It has two rail wheels, which run on the same rail, and is driven by independent chain gear from the motor spindle. An accumulator is under the platform. The truck is intended to carry a load of five hundredweight and in addition to draw two trucks each carrying one ton at a speed of eight miles an hour.

The Soulanges Canal was officially opened by the Canadian government a short time ago. The canal has been under construction for seven years and cost \$5,250,000. The power house is situated 5 miles from the upper end of the canal. Hydraulic power is used in generating electricity, and a working head of 20 feet can be obtained from the canal, five hundred electrical horse power can be developed, says The Electrical World, and the power is used for operating the locking gate machinery, sluice valves and road bridges, of which latter there are seven which swing on a pivot set in the side of the canal instead of midstream as is customary, and also for the general lighting of the canal. Arc lights of 2,000 candle power are placed along the north bank at intervals of 480 feet.

The cheap fence telephone system for farmers, recently described in the SCIENTIFIC AMERICAN has been in use in Texas for a long time. At Midland, on the southeastern foot of the great "Staked Plain," a large number of outlying cattle ranches are connected with the city telephone system in this manner. Some of the lines are 25 to 50 miles in length and according to another correspondent, are even 100 miles long. The distance owing to the angles is usually twice the air line length. During ordinary weather they render perfect service, in damp weather they work rather poorly, owing to lack of insulation. The practicability of this plan has been known in that section for seven or eight years. Our correspondent is probably correct in saying it had its origin in Australia. We gave an account of this interesting telephone system as used in Australia several years ago.

The International Traction Congress, which is to be held in connection with the Paris Exposition, promises to be of unusual interest and importance, especially in view of the development of electric roads, which will form an important part of the programme. The Congress is to be held under the general direction of the International Traction Union. The committee includes a number of prominent men in this branch, the president being M. Leon Janssen, Director of the Traction System of Brussels, and the members include a number of directors of different systems in France, Germany, Austria, England, etc. America is represented by Mr. J. M. Roach, President of the American Traction Association. A detailed list of the general topics and the questions relating to each, has recently been published; the following is a general outline of the points to be considered. Consequences of the application of electric traction; advantage and disadvantage of standard or narrow gage with reference to electric roads; arrangement of central stations; systems of current distribution; discussion of the Polk railway joint; accumulators, car-heating, branch roads, questions relating to electric motors and generators. The secretary, M. Nonnenberg, may be addressed at 85 Rue Potagère, Brussels.