

cases of low-tension magneto ignition. The valves are mechanically operated and are interchangeable, two sets being used, one on each side of the motor. The type car may carry either cellular radiators or those of the finned tube pattern, while some of the cars use flattened tubes provided with radiating fins. The type car carries two separate brakes, one of the expanding ring type, the other a band brake, acting within and on the outside of a drum on the rear wheel. The band brake, worked by a pedal, is for ordinary use, and the expanding ring brake, which is applied by the hand, is used for emergency. Finally, we note that the engine is controlled by separate spark and throttle levers, mounted on stationary sectors in the steering wheel.

It is a matter of congratulation that the industry has now grown to such proportions that the manufacturers are enabled to turn out a standard car which is at once superior in construction and lower in price.

#### PROGRESS WITH THE ELECTRIC AUTOMOBILE.

Although King Gasoline has gone on rapidly conquering the world, the beggar maid, Electricity, is soon coming to her own. She has been hard at work for the past several years doing more and more of the world's drudgery, and, according to present indications, she will yet have the honor of moving a considerable percentage of its pleasure vehicles as well.

The improvements that have been made in electric automobiles are of two kinds, namely, those in the vehicle and motor, and those in the battery. One class is quite as important as the other and the changes made during the last few years have been almost as great in the one as in the other. The result is that the modern electric vehicle for pleasure purposes can now be constructed to consume only about 50 watt-hours per ton mile at a speed of 15 miles an hour, where some years ago it used nearly three times as much; and reliable batteries delivering 15 to 18 watt-hours per pound can be had, as against the 8 or 9 watt-hours of usual practice. Thus it will be seen that vehicle and batteries have improved 100 per cent. That this is not merely theoretical improvement is seen from the fact that an electric stanhope having a guaranteed mileage of 85 on a charge, is now on the market, and larger, long-distance pleasure vehicles are being rapidly perfected. In France last fall several "raides électriques" were made to show what can now be done with ordinary stock vehicles. The most notable of these was the run from Paris to Trouville (about 130 miles) on one charge. Even more worthy of notice was a trip in this country from Cleveland to Erie (100 miles) over ordinary country roads some of which were sandy and which included several steep hills. A trip such as this on one charge makes the possibility of the practical electric touring car seem within grasp. With the high-capacity batteries and the improved motors and methods of power-transmission, the discharge rate of the battery is lowered with respect to the capacity, which results in lengthened life, so that a year of service can be assured before the replacement of the positive plates becomes necessary. A set of negative plates will usually outlast two sets of positives, and the upkeep of the battery can usually be placed at a fixed sum per annum.

Regarding types of storage battery other than the lead-lead type, there has been no great advancement of late. The lead-zinc battery, if ever perfected, will doubtless be the ideal battery, as the light weight of such a battery (25 watt hours per pound) coupled with its high voltage (2.5 volts) and heavy rate of discharge possible make it just what is needed for automobile work. The Edison battery is practically perfect in the last-named respect, as a heavy discharge does not affect the capacity. Bulk-for-bulk, too, the Edison battery is lighter than those of the lead type. Its low voltage (1.25 volts), however, makes more cells necessary, and it suffers such a serious loss of capacity under the effect of cold as to make it impractical. The results of an interesting series of tests of this battery by a well-known foreign electrochemist were published recently in the SUPPLEMENT. Despite the defect mentioned, this expert believes that batteries of the Edison, or nickel-iron, type will in a few years drive the lead battery from the field.

The method of power transmission found to be the most efficient is a single motor with individual chain drive from a countershaft to the rear wheels. On heavy vehicles two motors are generally used, but the chain drive replaces the old-time spur gear. With two motors the battery cells can always be connected in series, and none can be discharged more than others. But if a connection breaks the vehicle is stalled until a repair is effected. The low-voltage battery (12 to 24 cells) is largely used for light vehicles and even some of the largest machines are now so equipped. Its advantage is a smaller number of cells; its disadvantage, inefficiency in charging from 110-volt circuits, as energy is lost through a rheostat.

In the business and commercial vehicle line, for city work, the electric still reigns supreme. Hansom cabs, coupés, delivery wagons, and trucks are daily increasing in numbers. Besides their readiness in all weathers they do not emit smoke or the odor of half-

burned gasoline—a nuisance that has become so great as to be the subject of legislation and police interference in London. The speed of the passenger-carrying electric is as great as that of the corresponding gasoline car for city work, and they have all the advantages, without the liability to breakdown of the latter.

Among novelties in the electric vehicle line may be mentioned an electric tractor, or fore-carriage, which can be used with various bodies, and a trolley arrangement by which an electric automobile can be run by current from the street railway trolley wire, and at the same time recharge the batteries, when following the track.

#### INCREASING DEMAND FOR THE MISSISSIPPI PEARL.

BY K. L. SMITH.

If the truth were known about many of the pearls that we see nowadays, we would discover that a fair share of them, even among the expensive ones, came from the Mississippi River or its tributaries. Pearl hunting in these localities has become an established business, and regular pearl prospectors are examining rivers and creeks, with a view to locating beds of mollusks that may contain valuables. Attention to the rare pearls to be found in these streams was first called about twenty years ago, when large numbers of pearl-producing mollusks were found in a small creek in Dane County, Wisconsin. The farmers began searching the beds of streams with such success that thousands of pink, purple, and blue-tinted treasures were sold, bringing in a profit of many thousands of dollars. The excitement that prevailed at that time gradually died down, but enthusiasm has broken out again in localities bordering on the Mississippi.

There is a fascination about the business that smacks strongly of speculation, for a man may find any time a gem that may mean a fortune. The men who live this outdoor life are rugged and healthy, and each carries a tin box, which in one season may become the receptacle for holding thousands of dollars' worth of large and small pearls. The pearl hunters have learned to be experts in valuing their finds, and few gems sell at small prices. Generally they are sent East to lapidaries to be valued, and they are sold at once, for the pearl hunter knows that he does well to avoid the "middleman," who is sent out by eastern firms to gather the "finds." Some pearls are sold for a thousand dollars, and a necklace twenty-eight inches in length, made of small Mississippi pearls for the great singer Nordica, who desired a souvenir of Minneapolis, cost two thousand dollars.

Pearl hunting is an exact science, and the successful hunters are skilled in the business. Usually the prospector has a boat, which he allows to drift with the tide. Behind this is fastened a long pole, to which is attached hundreds of lines with bait on the ends. The mollusks close their mouths over these with tenacity, and as they are hauled in as soon as the lines are filled, many bushels are obtained daily. This is the easiest part of the process. The next operation is to open them, which if done with an oyster knife is so laborious it lives long in the memory of the novice. On this account most prospectors either steam the mollusks over a mild fire, or spread them out in the sun to slowly dry, when the two parts of the shell separate readily. The exciting moment comes when the contents of the shell is divulged, for much or nothing hangs on the revelation.

In fact, this insignificant-looking, dirty clam that may contain a treasure of value is an object of interest in itself. Content to lie in almost any kind of water, living on animalcules, very prolific, and a pearl producer, he travels slowly back and forth from mid-stream to shore unless he is gobbled up by the muskrat, who loves him dearly and eats him, pearl and all. The pearls are always near the shells, and can be squeezed out of the meat, with the fingers. Sometimes they are found loose in the shell, and at other times they are attached to it. If loose, the chances are that they may fall out, and good pearl hunters on this account search the bed of the stream, and even dig up the dirt to see what will "pan out."

In the early days of the industry, the slugs or small pearls were thrown away, but now they are kept and sold by the ounce or separately. These are always in the meat, and sell from two to five dollars. New processes in setting jewelry have made them in demand. Contrary to general belief, the expensive pearls are not always round or oblong in shape. Many fine specimens are "baroques," that is, they assume grotesque forms, a fact that can be accounted for by their origin, for scientists tell us that a pearl is really a malformation caused by some foreign substance finding entrance to the shell, and irritating the mollusk to such an extent that he exudes a liquid, which hardens and eventually becomes a precious pearl.

The prospector moves from one part of the stream to the other as soon as one mollusk bed is devastated. Some beds seem to contain more pearls than others, but it is the size and thickness of the pearl that make it invaluable for some articles of jewelry, and lapi-

daries in our large cities are using them freely. If any criticism is to be made, it is that they lack the yellow tint of the Oriental product. Many sell for high prices, however, and the black pearls which are occasionally found are exquisite.

To the casual observer, pearl hunting seems the easiest way in the world to earn a living, but it must be remembered that not one in fifty of the right species contains a pearl, and many mollusks are so light colored that they are known to be valueless, and are thrown away without being opened. It is a hit-and-miss sort of business, into which many start. Those that remain to the end get a good living, and every summer finds so many engaged in the work, that pearl hunting has become one of the established means of livelihood in the Mississippi Valley.

#### SCIENCE NOTES.

In a paper presented to the German Physical Society, F. Meyer treats of the permeability of argon for the ultra-violet rays. He uses an apparatus which is the same as he employs for ozone researches and is on the same plan as the photo-electric photometer devised by H. Kreussler. A glass tube 8 inches long and 2 inches in diameter, closed at the ends by quartz plates, is used as an absorption tube. After filling the tube with a mixture of argon and nitrogen, the author measures the extinction of the radiation by alternately inserting or removing the gas tube. The results he obtains show that argon is quite free from appreciable absorption for ultra-violet rays between  $\lambda = 186$  and 300. In any case the absorption does not exceed 3.2 per cent under the conditions of the experiment. As the ordinary air contains about 1 per cent of argon, the latter cannot play any important part in the absorption of the sun's rays having short wavelengths. Accordingly, we must abandon Hartley's hypothesis, which holds that the substance contained in the air and to which is due the sudden ending of the solar spectrum for  $\lambda = 293$  is identical with argon.

A new process brought out in France relates to the preparation of a derivative of castor oil which can be mixed with the mineral oils. A product of this kind has been already obtained by distilling castor oil up to the point where it loses a determined weight, and stopping the distillation before a product of gelatinous appearance is separated out. The present process, which avoids the losses coming from the distillation and also suppresses the disadvantages which are well known in connection with the dry distillation of oils, consists in heating under pressure the oil to be treated. To carry this out the oil is heated under a certain pressure in a tight boiler until it becomes capable of mixing in all proportions with the mineral oil. It is recognized that the best results are obtained with a temperature of 260 to 300 degrees and a pressure of 4 atmospheres by keeping up the heating for some ten hours. Then the boiler is left to cool completely before it is opened. The product which is thus obtained can be mixed directly with the mineral oils. Observations which have been made up to the present also show that by operating in a closed vessel we avoid all danger of forming a gummy product from the castor oil.

L. Sindet, of Paris, finds that certain metals such as copper when placed under constantly aerated water in the presence of iron act to increase the oxidation of the latter, and that others like tin, lead, zinc, aluminium, and magnesium keep back the rusting of the iron just as alkaline carbonates do. Among the bodies which prevent the rusting of iron, arsenic holds the first place with its compounds. In presence of aerated water they furnish arsenious acid and perhaps suboxide of arsenic  $As_2O_3$ . Using arsenic in large quantities sometimes the oxidation of the iron is entirely stopped, or again it is only slowed up. Arsenic acid, arsenites, and the alkaline arsenites at 1 per cent strength completely stop the rusting. Orpiment (sulphide of arsenic) gives also a strong effect. Wishing to apply his researches to the study of the causes of rusting of tinned or galvanized iron cans which are used to carry denatured alcohol, he finds that the carbureted alcohols containing 50 per cent of light benzene have a great activity in the production of rust. Benzene having an equal volume of alcohol added to it appears to triple the speed of rusting. Aldehyde, ethyl or methyl acetate do not provoke the oxidation, but they attack the zinc, the tin, then the iron of the vessels, and it is the acetates of zinc, tin, or iron from the decomposition which begin the rusting of the iron, especially in the presence of benzene. Although arsenic, etc., totally stop the oxidation, and this during several months of contact, it is evident that we could not use them here, seeing that even though the alcohol dissolves but traces of arsenic, the latter is oxidized in the liquid and the products of the oxidation are more solid than the arsenic itself. He was able, however, to give a steel sheet a surface cementation by arsenic and it did not rust, while a non-treated sheet exposed at the same time to moist air became entirely covered with rust.