AUTOMOBILE COUPÉ BUILT FOR THE SULTAN OF MOROCCO.

Our illustration shows a coupé which has been built for the Sultan of Morocco by the Georges Richard Company. It is finished in green, with gold tracery. In front is the refrigerator, and in the rear the place for the footman. The interior is luxuriously fitted with silk linings and curtains, a double seat for the conductor and passenger, with the steering and controlling levers. Like the Georges Richard vehicles which have been lately described, it is on the gasoline system, and the motor, placed in front, drives the differential of the rear wheels by a belt transmission.

AUTOMOBILE BUILT FOR THE SULTAN OF MOROCCO.

A NOVEL THREE-WHEEL AUTOMOBILE.

Although the four-wheel automobile represents the type found to be in most general use, there is no doubt about the motor-bicycle and the three-wheel automobile having many friends and advocates. The admirers of the three-wheel machine claim for this type of vehicle comparative lightness and, consequently, greater traveling radius for the same amount of fuel, compactness, ease of steering, ability to turn in a circle of surprisingly small diameter, and last, but not least, a considerable reduction in the cost of this class of vehicle. As opposed to this class of vehicle there are some who prefer the four-wheel type, owing to the greater stability of this form of machine. A Philadelphia advocate of the three-wheel design, Mr. George T. Turner, is the designer of the three-wheel vehicle shown in the accompanying engravings. The vehicle is certainly very compact, as it can be stowed away in a space 7½ by 3½ feet, and it is said to be an efficient machine.

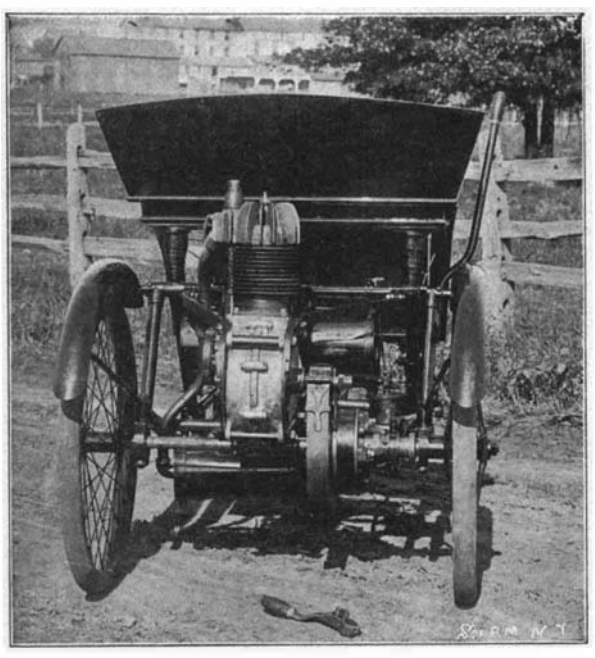
An evidence of the practicability of the Turner runabout is given in the fact that the original vehicle, constructed four years ago, is still in daily use on the streets of the Quaker City. Weighing but 400 pounds, it is yet so constructed as to safely carry two passengers over ordinary American roads with entire safety, its low running gear (but 20 inches from the ground) obviating the necessity of equipping the vehicle with a step. It has a speed range of from five to twenty miles an hour, while its tanks, with five gallons storage capacity, have proven sufficient for the round trip from Philadelphia to Atlantic City (about 120 miles) in the actual running time of but a trifle over six hours. This amount of fuel costs but fifty cents, and two passengers occupied the vehicle during the trip.

The starting, stopping and braking are all done with the one lever (with an additional foot brake). Mr. Turner is now engaged in perfecting a device by which the engine may be started from the seat.

Automobile Storage and Repair Facilities.

The proper storing of automobiles, with all that this implies in the way of taking constant and intelligent care of the machine, and the establishment of efficient repair shops, still remain in a very unsatisfactory condition, despite some commendable enterprise in certain quarters. The manufacturers of motor vehicles are well aware that a great many people are deterred from buying machines because of the lack of repair shops able to do good, responsible work. Chauffeurs of extended experience are constantly complaining of the varying grade of the liquid fuel which they pick up along their touring routes, and those who depend on electricity argue that they are constantly at odds to obtain a uniformly satisfactory charging of the batteries. Such complaints are usually well justified. Instead of dissolving their usefulness in "experience" meetings and festive entertainments, the automobile clubs might to advantage take hold of these problems with a view of alleviating the most apparent troubles of the touring chauffeur who is in search of uniform quality and excellence in liquid fuel and charging voltage.

But there is another side to the matter, affecting what will undoubtedly prove to be the most essential and useful class of motor vehicles, namely, the heavy truck, the delivery carriage, and the general utility wagon, in relation to a system of storage stations comprising city and urban limits. Department stores and similar large establishments, which are gradually displacing horse-drawn teams by horseless equipment, are already spending too much for maintaining the machines and keeping them in repair. We are slowly but surely approaching the time when centrally located storage stations will be necessary to the further economic spread of horseless traction, at least in cities. Such stations should also be able to furnish well-qualified drivers and chauffeurs to operate delivery wagons at a stated weekly or daily rate, and to take contracts for supplying efficient chauffeurs for such concerns as are constantly employing horseless traction and transportation, not only in the city, but in the suburbs and surrounding country where automobile stage lines operate. It should be possible for an individual as well as a representative of a commercial house to walk into such a storage station and immediately get a figure on the cost of operating motor vehicles, according to capacity, per day and per week. The price should include the driver's salary, the recharging of the batteries if the vehicle is an electric, or the supply of liquid fuel and lubricants if it is a hydrocarbon or steam vehicle, in order to enable the inquirer, if he is a merchant, to know precisely what the cost of each delivery would amount to. All the merchant has to do is to specify the hours of work and time schedule to be followed by the driver, and at so much per week the storage station agrees to keep the vehicle in running order, making trips with the regularity of clockwork. By this arrangement the merchant is relieved of much special superintendence, which really does not belong to his business and which he is not qualified to do properly through any of his departments. A fixed price for the vehicle and so much to make it do its limit of work and usefulness—these are the only two items which would concern the city merchant. Besides, there are any number of concerns which do not care to invest money in purchasing vehicles, but have enough expressage on their hands to warrant the hiring of one or more motor vehicles, when this can be done conveniently and economically. Only in exceptional cases does the driver of a business motor vehicle know how to properly attend to and clean it after the day's work is done. He is in a hurry to get home, and regards the cleaning of the machine as an extra job imposed upon him for the reason that there is no one else to do it. Consequently the vehicle is not taken good care of, the machine parts wear out comparatively quickly, and continued negligence may prevent the smooth working of the machinery, necessitating frequent stoppage and summons for repairs.



REAR VIEW, SHOWING MOTOR OF THE TURNER THREE-WHEELER.

THE TURNER GASOLINE THREE-WHEELER.

A well-appointed storage station should be able to do the work of cleaning and adjusting motor vehicles by contract for less than half the cost of the repairs, delays and loss by friction of neglected vehicles; for the cost of looking after several machines is but a little more than that for tending a single machine. In all the large cities there are at the present time dozens of expensive and well-built business vehicles which are being slowly wrecked by the ignorance and negligence of the drivers intrusted with them; and it is not at all unlikely that some of the firms, discouraged by the cost of repairs and the unsatisfactory running of the machines, may ultimately go back to the horse-drawn outfit, unless a system of storage stations comes to the rescue. At present nearly all the atuomobile stores are located on thoroughfares convenient to fashionable patronage; very few of them are close to the city's business heart. There are in the United States several manufacturers making a specialty of business vehicles, and these might with profit locate salesrooms, with ample storage facilities, in the business center of some of our big cities. The storage idea worked out intelligently would not only insure a large number of sales not otherwise obtainable, but would keep the seller in constant touch with the buyer—a condition both are sure to welcome. After all, the revolutionizing influence of the automobile will be felt, not through the pleasure machine, but through the manifold appliances of motor vehicles to business needs. When we are getting our fires extinguished by auto engines, our goods delivered by auto express wagons, our streets swept by auto street sweepers, our household furniture and heavy freight moved by auto trucks and vans, not to mention suburban transportation by auto stage coach, then, and first then, will the influence of the horseless vehicle assert itself in a way calculated to extract our appreciation. When we go outside city limits the conditions are simply desperate. The bicycle repair shop, the blacksmith's shop, and the general mechanic's shop are the only places of refuge, and none of them offer adequate assistance in case of accident. They merely are the local mechanical centers, which the wrecked automobilist goes through, not without a lurking suspicion that he will have to do most of the repairing himself or take a botched job. There is only one way out of this dilemma. If the automobile clubs of the United States, instead of being managed as at present purely for pleasure purposes, would amalgamate into a single compact body able to make its voice heard in legislative quarters, it should not be so very difficult to organize repair facilities all over the country by some such measure as that of the League of American Wheelmen. L. A. W. repair shops did much good in stimulating the zeal of mechanics in practical cycle repair work. The cycle repairer is closer to auto repairs that either the blacksmith or the general mechanic. It might be well worth a trial to use the L. A. W. repair men as a basis, and educate those of them who care to acquire a certificate signed by the united automobile clubs licensing them to do work as qualified automobile engineers. The essential technical instruction could very well be done

satisfactorily by mail by way of a clearly written, illustrated pamphlet—adopting the method of teaching in vogue with the correspondence schools—and the practical knowledge of how to do automobile repairs properly could soon be gained by intelligent application. But until some such method is brought to bear on the available and favorable elements in present conditions our automobile repair and storage facilities will continue to remain the weak spot in the industry.

A MOTOR SLED.

There is no reason why an enthusiastic cycler should not enjoy his favorite pastime in the winter as well as in summer. Our illustration shows a motor-bicycle which has been converted into a motor-sled by simply substituting a pair of runners for the front wheel. Mr. I. H. Whipple, the designer and owner of this peculiar vehicle, delights to race his machine against the fast horses on Chicago's speedway, which he can easily outdistance. The machine is a converted Mitchell motor-bicycle driven by a 2 horse power motor and said to develop a maximum speed of thirty-five miles an hour. As a motor-sled, however, the inventor claims a speed of forty miles an hour. By having two parallel runners in front an upright position is assured to the machine and the steering of the machine easily controlled. The runners are attached to a cross-bar secured to the front forks, and are adapted to be removed in summer time. The cross-bar, however, may be retained and serve as an axle on which a pair of wheels may be mounted, thus converting the machine into a tricycle. An additional seat may be added at the front of the machine if desired, the motor having ample power to propel the additional weight.

A MOTOR SLED.

A NEW WATER-LEVEL REGULATOR FOR STEAM BOILERS.

The accompanying illustrations give a general view and cross section of a very simple automatic apparatus for regulating the water level in a steam boiler. The device has just been patented by Mr. Nelson Curtis, of Boston, Mass., who invented it for use on automobiles, although it is readily applicable to any steam boiler.

This regulator is constructed to operate by the well-known principle in hydrostatics that a column of liquid of a given height, however small in diameter, will counterbalance or lift a great weight, provided it acts against a sufficient area at its base.

An inspection of the diagram will show the reader that the upper half of the vertical stem, above the connection with the boiler, consists of three tubes numbered 1, 2 and 3 from the outside, inward. The second of these tubes terminates below in the upper part of the diaphragm chamber, *D*, while the third one passes through the flexible phosphor bronze diaphragm and ends in the lower half of said chamber. Attached to the diaphragm on its under side is a needle valve, *N*, which is opened or closed by the fluctuations of the former. This valve, upon opening, admits boiling water and steam, through the pipe, *P*, to the supply pipe of the pump, thus checking the suction of the latter and making it non-operative; or the water and steam liberated through valve, *N*, since it has the boiler pressure behind it, may be made to operate a by-pass valve, thus checking the feed-water from entering the boiler.

When the boiler is filled with water the first time, and steam is raised, the pressure forces water up through the outer tube, *I*, the water level, of course, being then above inlet pipe, *J*, into filter chamber, *F*. It is then forced through the filter and enters tube 2 through small holes in the wall of the latter, connecting it with the narrow chamber below the filter. This water descends through tube 2, filling it, and the chamber, *D*, above the diaphragm. The weight of this column of water on the diaphragm (4 pounds) causes it to close the needle valve, *N*, which has been held open by spring, *S*, on top of tube 3.

As soon as tube 2 has filled, water is forced up into chamber, *C*, and begins to fill tube 3. The cap on top of chamber is unscrewed a little the first time apparatus is filled, in order to keep the air in tube 3 from becoming trapped at *C* when the water enters the tube.

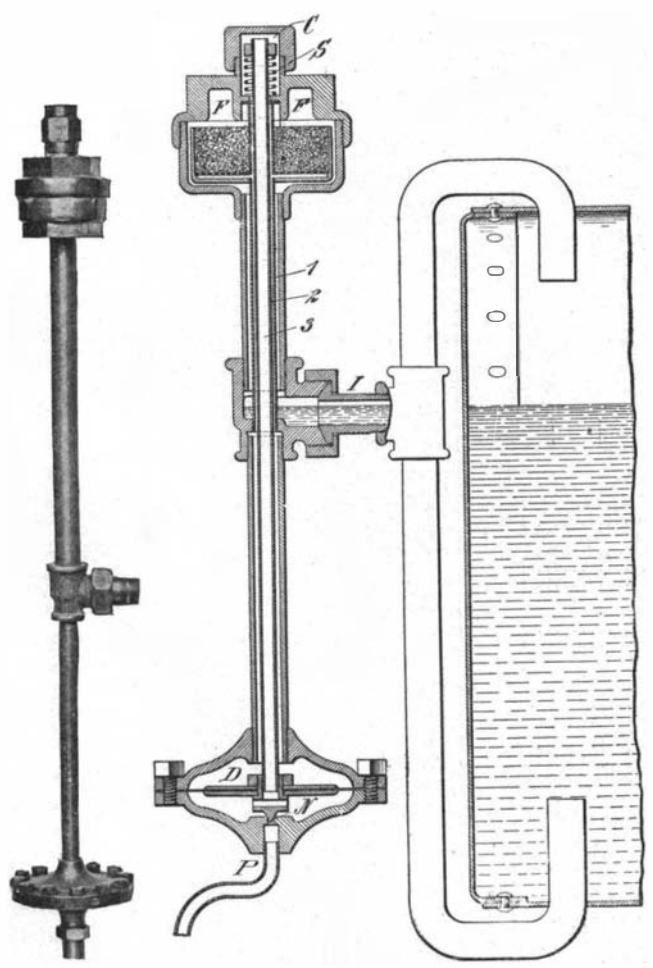
The water thus forced into tube 3 fills the chamber below the diaphragm and, as it rises in 3, tends to counterbalance the water in tube 2. When it reaches about the middle point of 3 it has balanced half of the water column in 2, and the spring then has sufficient stiffness to lift the valve against the weight (2 pounds) of the upper half column in 2. As the steam pressure acts on both sides of the diaphragm it balances itself and can be neglected.

As soon as the valve opens the boiling water has access to the feed pump, and the latter ceases to work.

When the level in the boiler falls below the top of horizontal pipe, *I*, steam blows through into tube 3 and tends to drive out the water in it through the open needle valve. As soon as the level in 3 is in this manner lowered some six inches the weight of the water column in 2 becomes too great for the spring, *C*, to withstand, and the valve, *N*, is closed till the water level in the boiler rises above the entrance to pipe, *I*, when the same operation is repeated.

The regulator, as at present constructed, is from 15 to 24 inches in height over all, and when this height can be obtained below the water line of the boiler, pipe 1 is not needed.

It can be readily seen that the stopping and starting of the feed pump is thus dependent upon a variation of level in the boiler of about ¼ inch, or just enough difference to cover and uncover the mouth of pipe, *I*. As the apparatus has no moving parts except the needle valve, and as this is protected by a filter, it cannot ordinarily get out of order, but is continuously automatic in its action. The inventor informs us it has been in successful use for some time and has given entire satisfaction.



THE CURTIS WATER-LEVEL REGULATOR—GENERAL VIEW AND CROSS SECTION.

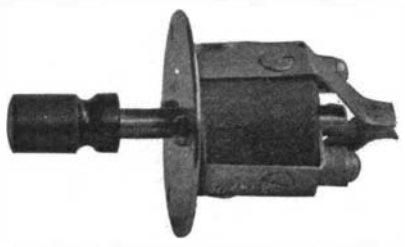
The Chicago Automobile Show seems to be doing what such an exhibition should do. The Jefferys have received seventeen orders since the Show began; the makers of the Elmore carriage have received fifty orders. Many of the manufacturers have not exhibited simply because they cannot take orders. The Show was certainly a great success. There were many buyers, and hundreds of agents who were willing to give orders and to pay cash for automobiles if they could but get the agency.

AUTOMOBILE NOVELTIES.

THE ELDREDGE VOLTMETER AND BATTERY SWITCH.—These are shown in the annexed illustrations and they will be found very useful by almost all automobilists. The voltmeter, besides being conveniently constructed in the shape and size of a watch, is an accurate instrument, and can be used in testing both primary and storage batteries.

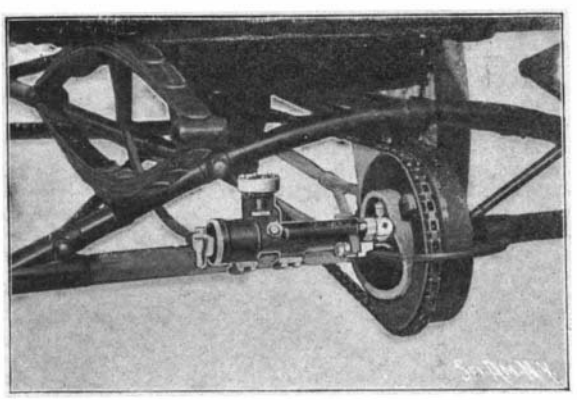
BATTERY-TESTING VOLTMETER.

The plug switch is intended for gasoline vehicles, where it is inserted in the ignition circuit. The two wires of the circuit are fastened to binding screws on the two flanges at the back, and the pin makes a connection between the two when it is pressed all the way in. When partially withdrawn, as shown in the cut, the pin is held in place by a concealed spring. The pin can be entirely withdrawn and placed by the operator in his pocket, when he leaves the vehicle, thus preventing it from being tampered with during his absence.



PLUG SWITCH FOR IGNITION CIRCUIT.

THE REASON AUTOMATIC AIR PUMP.—This is a slow running pump intended to be attached to the back axle of a steam carriage for the purpose of always keeping up the pressure in the air tank. It is entirely automatic and can be set to start and stop at any desired pressure from 5 to 80 pounds. It can also be connected so as to be started and stopped from the seat when the operator so desires. The pump is driven by a cam attached to the side of the differential gear, as shown in the illustration.



THE REASON AUTOMATIC AIR PUMP FOR STEAM CARRIAGES.

In a recent lecture in Glasgow, J. D. Dunlop had something to say of the part taken by Americans in developing the automobile. "Strange to say," Mr. Dunlop remarked, "the Americans, who are such a go-ahead people, made little headway in the manufacture of petrol cars. They have, I think, been too original, and left the beaten track too far. They devoted a great deal of time and energy to the development of the electric car, which has not proved a commercial success; it is admitted, however, that they brought the steam car to a high degree of perfection. They have now returned to the beaten track, and are making considerable progress with the more commercial petrol car."