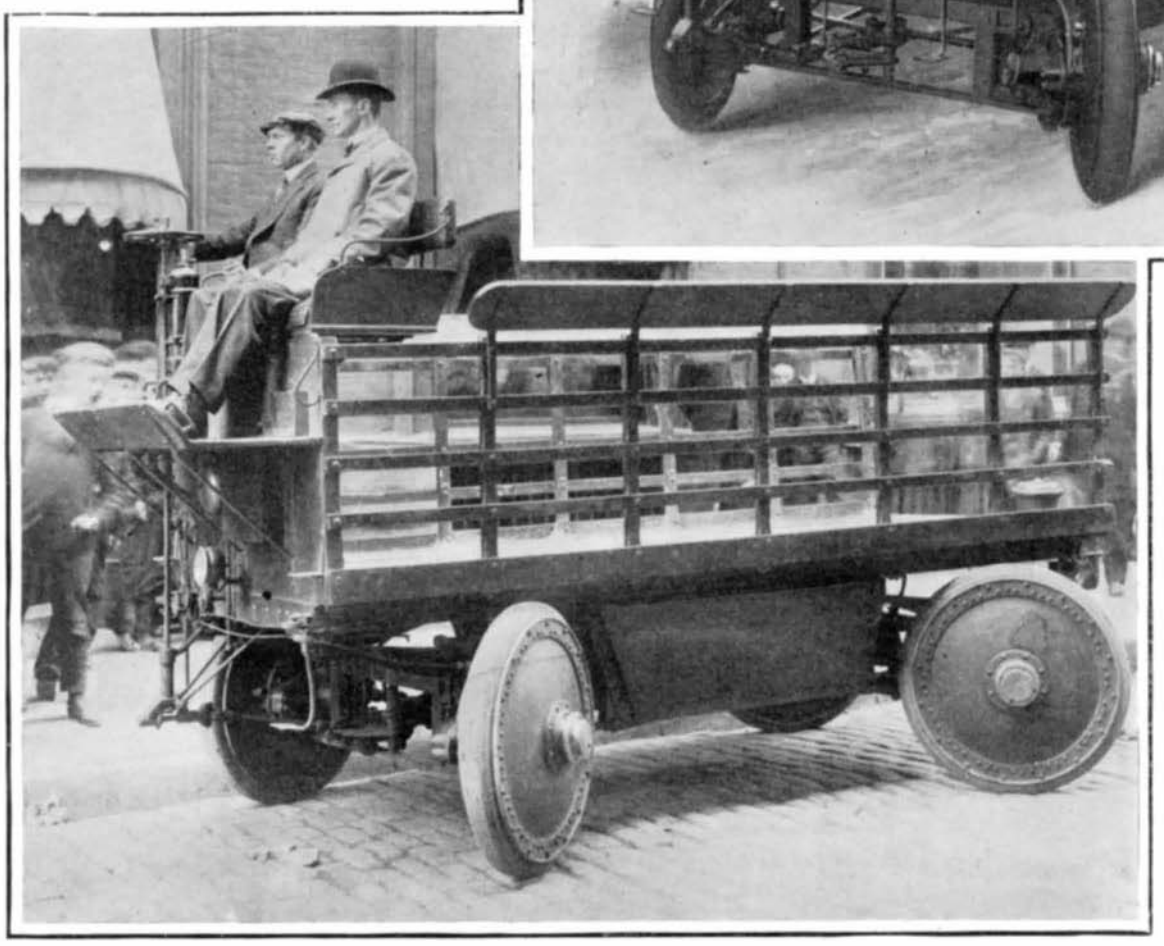
NEW TYPE OF ELECTRIC TRUCK.

The electric truck shown in the accompanying illustrations is fitted with a single electric motor within each wheel. The motor is a high-speed one of the bipolar series type and is normally rated at 2 horsepower. It rotates at a speed of 1,400 R. P. M., which is reduced in the ratio of 25 to 1 through single reduction gearing of novel construction. With this reduction, the motors drive the truck at about 6 miles an hour.

The great traction and control secured by a four-wheel drive is shown by the photo of the machine dropping off the curb slowly and closing a watch case lid without breaking it. The truck can be backed against a 12-inch curb and then made to climb it from rest. This feat was done with it recently in the presence of the writer, and it furnished a striking demonstration of the tractive power of the truck. In doing this feat, the ammeter needle jumped only to the 150 point for a brief instant, which corresponds to a 100 per cent overload of the motors—an overload which is never exceeded. So effective is the traction that the truck was able to pull stalled horse-drawn trucks out of the snow last winter, even when equipped with steel tires.

The appearance of the interior of the truck wheel and the manner in which it is driven by the pinions on the armature shaft of the motor are made apparent by a glance at the views showing the wheel open and looking down upon it, with rim removed.

As can be readily seen, the frame that carries the field magnets terminates at one end in a hollow spindle which carries a roller bearing for the wheel and through which pass the wires for conveying current to the motor. The armature is placed horizontally and practically parallel with the plane of the wheel. It carries a bevel pinion on each end of its shaft. These two pinions mesh respectively with two gear rings which face each other and are attached to the hub of the wheel. The thrust of one pinion against the opposing ring is counterbalanced by that of the other pinion against the ring that faces it, so that a couple is formed, with the result that there is little or no thrust upon the wheel motor bearings. So much is the friction reduced by this arrangement, that the transmission loss from motor to wheel with a speed reduction of 14 to 1 has been found to be only 1 per cent with as high as a 16 per cent overload, while in the truck we illustrate it does not exceed 3 per cent. Consequently practically the full power developed by the motor is had at the rim of the wheel instead of anywhere between 50 to 70 per cent of this power, as is the case with the usual spur gear, double reduction transmissions usually employed. In order to allow for any wear and so as to always be certain that the application of power to the wheel is equally divided between the two pinions, each motor is fitted with an equalizing device that accomplishes this result.



Turning Position with the Front and Rear Wheels Following the Arc of a Circle.

Turning the Truck with all Four Wheels Parallel.

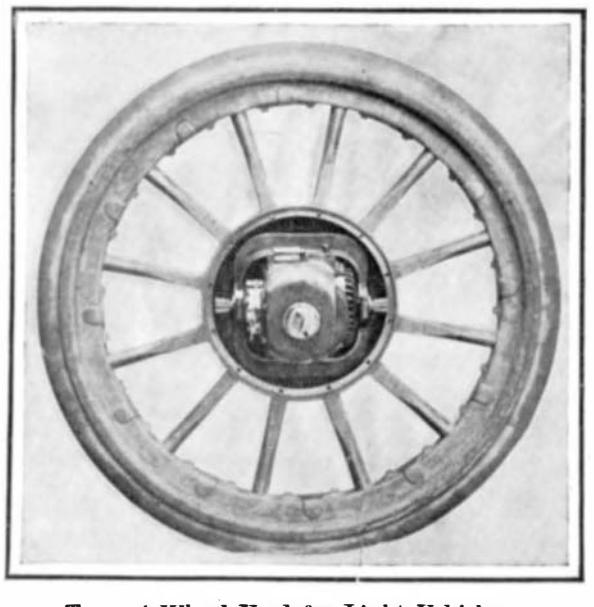
The controller used on the truck is of the usual trolley-car type. The diagrams show the connections made at the motors and controller to obtain the five speeds in either direction. In starting, each pair of motors is connected in series through half of the battery. For the second speed the armatures are kept in series and the fields are placed in parallel. On the third speed the motors are in parallel on half the battery. The fourth speed finds the fields in parallel and armatures in series on the whole battery of 42 cells, while on the fifth speed the motors are in parallel on the whole battery. The fourth speed gives the maximum torque and is the regular running speed.

On account of the great saving in transmission of power to the wheel through the single reduction couple-action gear, the 3 to 5-ton truck shown, whose weight complete is 7,700 pounds, will run on some 30 per cent less current than the ordinary truck of the same size. The result is that the battery and motors will last much longer than is usually the case, as they are never seriously overloaded. Under regular service conditions, about 3,000 miles can be got out of the battery before it will need cleaning. An examination of the motors by the editor of this journal showed them to be in very good condition, there being, apparently, no trouble from burning of the commutators due to jumping of the brushes from the excessive vibrations the motors would be expected to receive in the wheels. The tension on the brush holder springs, too, was very light.

Some tests made recently in New York city show the economy of the new truck under severe hill-climbing conditions. The hill at Ninety-first Street and Lexington Avenue, which is paved with cobblestone and has a 15 per cent grade, was mounted with the controller on the fourth speed with a current consumption of 112½ amperes at 75½ volts. The time taken in making the climb was 2 minutes 40 seconds, as against 1½ minutes when running empty (weight about 8,200 pounds) on a consumption of 68 amperes at 80 volts. The total horse-power developed with the 4-ton load was 11.37, and without it 7.15. On a level road the truck has carried 3½ tons at about 5½ miles an hour (fourth speed) on but 42½ amperes at 80 to 84 volts (5½ horse-power). The current and voltage used in the hill-climbing test were accurately measured by two separate sets of recently calibrated Weston instruments, so the observations are probably quite accurate. An ordinary two-motor truck, although capable of ascending a 15 per cent grade nearly twice as fast, consumes about three times as much current, and the heavy discharge rate soon ruins the battery.

The truck uses about 200 watts per ton-mile, where the ordinary one-ton delivery wagon consumes 475.

An examination of the pinions and bearings is said to have shown almost no perceptible wear after running the truck nearly 4,000 miles. When cost of maintenance is considered, therefore, it would appear that this electric truck would be considerably cheaper to run and maintain than a gasoline truck of equal size.

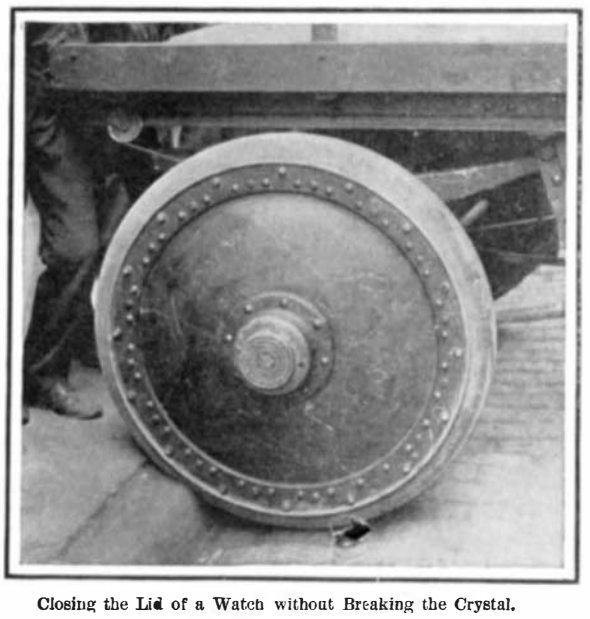


Type of Wheel Used for Light Vehicles.

The Manufacture of Cellulose from Cornstalks.

BY C. M. GINTHER.

After extensive and elaborate experiments by the government, it has been discovered that cellulose in considerable quantities may be extracted from corn stalks, and the industry promises to grow to gigantic proportions almost at once. Cellulose, as is well known, is the essential constituent of the framework or wall-membrane of all plant cells. It is a secretion from the contained protoplasm, but in the advancing growth of the plant the walls become incrusted with resin, coloring-matter, etc. It composes the cells of wood as wax composes the cells of a honeycomb. Cellulose, by reason of its peculiar properties, is being largely introduced into shipbuilding, as due to its property of swelling rapidly when wet, it prevents leakage through holes below the waterline. Up to the present century the only available material from which cellulose for this purpose could be prepared in sufficient quantities was the cocoanut shell. The ground fiber of the cocoanut shell with a small percentage of the original fiber constituted the cellulose of commerce.



Closing the Lid of a Watch without Breaking the Crystal.

Perfect Motor Control.

This wonderful material possesses the property of swelling rapidly when wet and is very light. It is practically free from danger of fire, burning very slowly, and with great difficulty when compressed. In France experiments made by firing a 10-inch shot through a mattress of cellulose demonstrated that the fibers came together and swelled so rapidly that only three gallons of water passed through the aperture, and in a short time the hole was closed entirely. Cellulose was first used in shipbuilding in 1884, but it obtained favor so rapidly that in 1890 the French introduced it into some forty vessels of their navy, and in the same year its use was ordered as a means of protection in the construction of ships in Russia, Holland, Japan and Greece, as well as in the American navy. It was soon demonstrated that the supply of cocoanuts in the world was far too small to furnish the cellulose demanded for warships alone, and search was made for a more plentiful and cheaper material. The Cramp Shipbuilding Company spent years in trying to find a substance that would serve the same purpose, and at last discovered it in such abundance that the question of supply was forever settled. Cornstalk, which the farmer has been throwing away as waste, was found to contain in its pith the very best material in the world for making cellulose. Almost immediately arrangements were made to build large factories in different parts of the country where corn was the staple crop. Three such factories have already been established in this country, and two in Europe. This corn pith, for ages considered worthless, has been found to contain not only cellulose to be used for protecting ironclad vessels, and preventing them from sinking in case their shell is punctured below the waterline, but also from it can be made smokeless powder, dynamite, and other high explosives, fine art paper, varnish, kodak films, car-box packing, filler, waterproof cloth, linoleum, imitation silk, patent leather finish, face powder, silicate packing, and a hundred other by-products the despised cornstalk was never dreamed to contain. The outer lining, that which contains the pith, is made into a substance which is used to adulterate flour, also as a cattle food, a poultry fattener, and egg producer. Some of it will be made up into candy, part into coloring dyes, and other properties have been discovered which make it one of the most useful substances the earth produces. It will add thousands of dollars to the crop receipts of farmers, which is almost entirely clear gain, since the product utilized is only that which was considered worthless.

The annual average corn area of the United States is not far from 80,000,000 acres. Each acre yields on an average about 4,000 pounds of cornstalks, or a total of 160,000,000 tons. Of this weight 85 per cent, or 136,000,000 tons, has value as feed, but not over 10 per cent of it is actually fed. The other 15 per cent of the total weight, or 24,000,000 tons, is the pith of the stalk, which has been a total loss, or even worse, since it required labor to dispose of it. One company pays $3 a ton for the stalks, and produces a material which is worth 17 cents a pound, or $340 a ton. It has been figured that every ton of cornstalks in the country could be so handled thatit would increase the value of each corn crop $480,000,000annually.

The "Kearsarge," the "Kentucky," the "Indiana," the "Illinois," and all the new war vessels that this country and all other nations are putting on the seas, have a double armament around the waterline, underneath the heavy Harveyized steel plates. It is composed of cellulose from corn pith, and is six feet in thickness. In the late Chinese-Japanese war the value of cellulose jackets under the steel was demonstrated in a very startling manner. In one battle two Chinese men-of-war were sunk by Japanese balls penetrating below the waterline and allowing the water to rush in and sink the ships; in the same battle one of the largest Japanese ships was struck below the waterline. The shot passed through a jacket of cellulose, which instantly swelled upon the water striking it, and closed the hole entirely. It is said that not a drop of water penetrated into the hold of the vessel. The ship continued in the fight, and afterward leisurely proceeded to dock, where the injury was repaired. Corn pith will hold twenty times its own weight of water, absorbing it like a sponge, and expanding over sixteen times its compressed bulk. These properties of swelling and absorbing water make it superior to any other substance for a like purpose known. The process of manufacture is elaborate. The stalks are cut, broken, and mashed, and then by a series of elevators and suction pipes, the stalks are screened and separated and disposed into various receptacles and treated chemically. Stalks of one crop are stacked and stored and permitted to sweat and dry over winter. After six or eight months they are thoroughly dry and ready to be taken into the factory. They are now cut into pieces one inch in length and then shaken, to cause the pith to fall out. After the stalks are cut they are not touched by the workmen again, all the rest of the process of manufacture being accomplished by automatic machinery. The pith is finally chemically treated, compressed to one-sixteenth in bulk, and made into blocks six inches square. The chemical treatment makes them fire-proof. The government into whose ships the cellulose in process of manufacture is to be placed always has a representative present to inspect the process of manufacture and to subject the material to various tests to insure its quality. Among other tests, each block of cellulose is subjected to a heat of one thousand degrees, and if it does more than merely sear, it is rejected. The blocks are then packed into waterproof boxes and shipped.

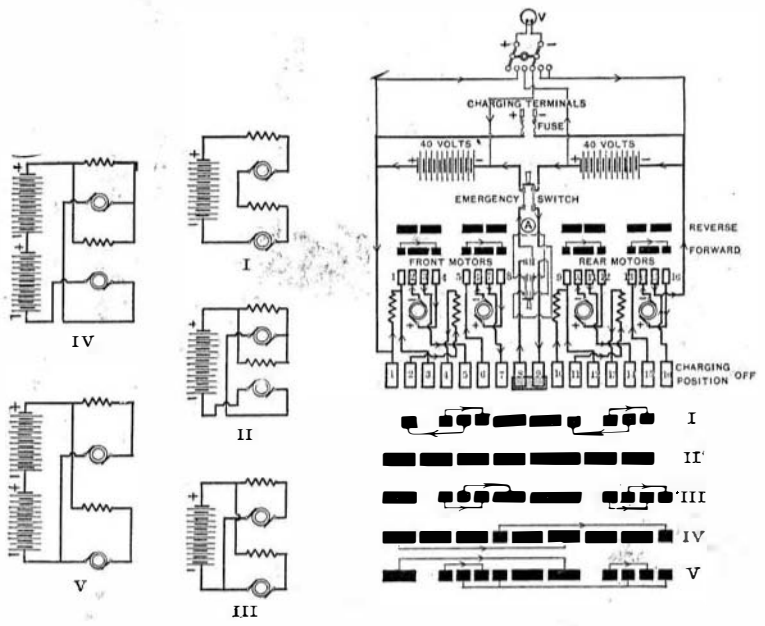
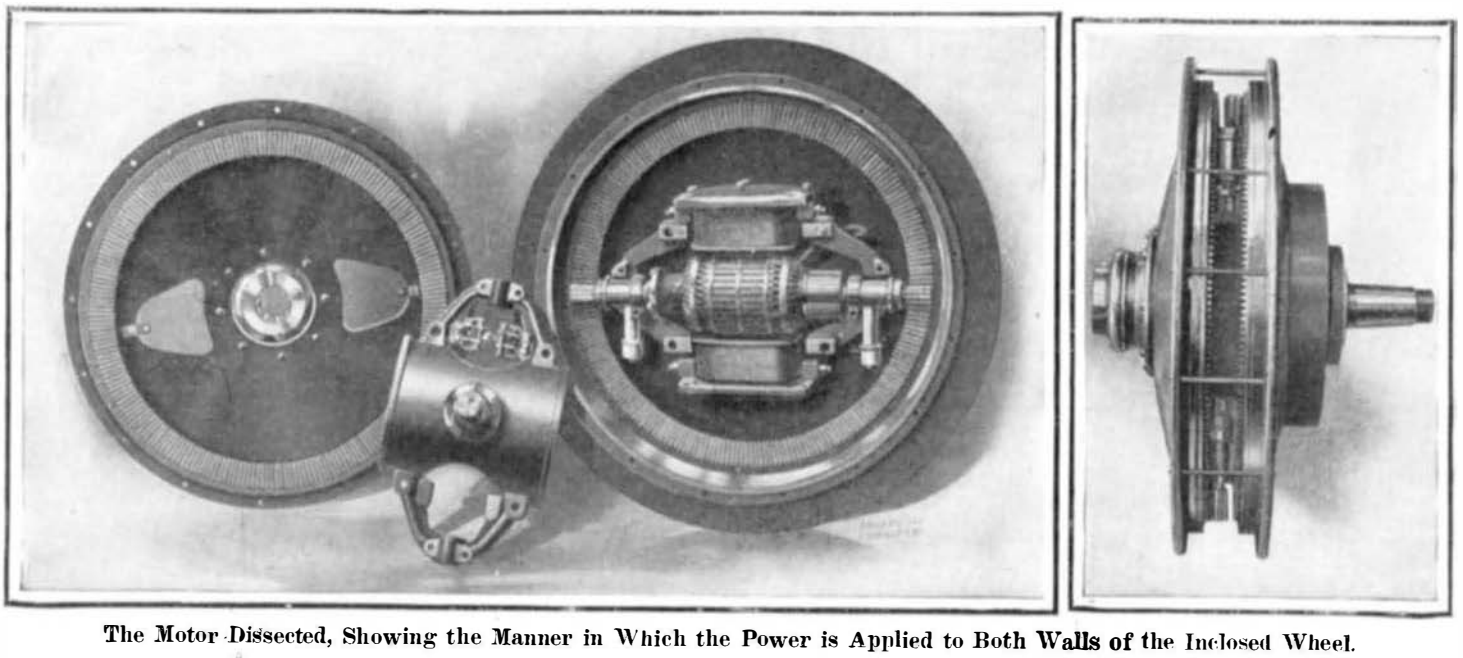


Diagram of the Controller Connections.

Duc d'Orleans Polar Expedition.

The steamer Belgica with the Duc d'Orleans on board sailed May 24 for Tromsoe on her way to the Arctic regions, where it is said the duke will attempt to communicate with the Ziegler expedition, headed by Mr. Anthony Fiala, of Brooklyn, N. Y.

The whaling steamer Belgica, recently purchased and provisioned for two years by the Duc d'Orleans, made a voyage to the Antarctic regions with a Belgian expedition in 1897, returning in 1899. The captain, the crew, and the scientific staff have each of them had experience in Arctic exploration. The duke will take charge of the naturalists' department.



The Motor Dissected, Showing the Manner in Which the Power is Applied to Both Walls of the Inclosed Wheel.

NEW TYPE OF ELECTRIC TRUCK.

Electrically-Operated Switches and Signals.

At the London terminus of the London and North-Western Railroad, an installation for the operation of the semaphores, switches, and crossovers by electric power is being carried out. The system adopted is the invention of one of the engineers to the railroad. The power is to be drawn from a generating station capable of supplying 700 horse-power. The heavy traffic at this terminus requires incessant backing of arrival trains into sidetracks, and the rapidity with which the movements of the switches and signals controlling these operations has to be performed, rendered the manual method impracticable. The operation of the electrical system is as follows: When the signalman moves a lever controlling a crossover or signal, the action becomes locked halfway; the movement transmits an electric current to the switch, and a small electric motor draws it over and then becomes disengaged. Simultaneously, a current returns to the cabin, and releases the locked lever, which can then be fully drawn over, a movement which assures the signalman that the crossover has been completely moved and is ready for the approaching train. The half-way stoppage of a lever on being first moved, which remains so until the electric current drawing together the crossover returns to notify that they have finally closed and thereupon releases the particular lever, is a protection against the signal lever being moved until the connection is complete. Any defect in the crossover, or any obstruction, such as earth, pieces of wood or other substance intercepting their proper closing, keeps the connecting lever in the cabin locked half-way and the signal at danger until the fault is rectified. A further safeguard is found in the action of the levers, which operate the signals governing the crossover so moved. The signal lever can be fully pulled over at once, and the signal is thereby instantly moved to the "all-right position," an electric current again having been sent and energized a magnet operating the signal. This current, however, does not go direct, but passes through a switch which is opened and closed by the crossovers, and if these have not moved correctly or are not actually bolted, the current to the signal is stopped, and the latter remains at danger. After the train has passed, the lever working the signal is moved back, and the signal arm, by gravity, instantly returns to the danger position. If it does not, the signalman instantly knows it, as a further check is provided by the lever then becoming locked halfway. It is only by the complete movement of the lever that the operator knows the signal has reverted to danger.

The object of the water-tube boiler is to reduce weights, give greater safety against explosion, greater rapidity of raising steam, and an increase of economy in the generation of steam. The various makes of water-tube boilers are too numerous to mention, but they divide themselves into two broad, general classes—those with straight tubes of large diameter, say four inches; and those with curved tubes of small diameter, from an inch to an inch and a half. Probably no single boiler possesses all the merits which a perfect water-tube boiler should have, and in nearly every case the attempt to secure certain advantages brings attendant disadvantages, and *vice versa*. The large straight-tube boilers are not so light as the ones with small tubes; and it is more difficult to secure adequate economy, which is dependent largely upon skillful baffling. They do not permit of such rapid raising of steam from cold water as the smaller tube boilers, because, like the Scotch boiler, they carry a large reserve supply of water in the boiler after the manner of the Babcock & Wilcox boiler. On the other hand, they permit the replacement of a defective tube and of the cleaning of a tube much more readily than the tubes which are bent. Likewise it is only necesary to carry one size of spare tubes, while the bent tube boilers require several.