as alleged had ever taken place at Sandy Hook or any other government proving ground.

We present illustrations of the gun as being a distinct curiosity showing, as it does, how absolutely Mr. Cullen and the papers that have lauded this invention have failed to understand the elementary principles of the modern rifled gun. Curiously enough they have overlooked the fact that the balls, being locked in by a cap at the muzzle, *could not roll.*

As a matter of fact the velocity would be reduced, and as the shell has no copper rifling band, it would be shot out of the gun without receiving any rotary motion about its longitudinal axis, the mere surface friction between the balls and the projectile being entirely insufficient to overcome its inertia.

So far as the velocity of the projectile is concerned it would be reduced below that of an old black powder weapon. The absence of the rifling-band which, in the ordinary type of gun expands under the pressure of the powder gases, filling the rifling and making a tight gas-check to prevent the white-hot powder gases from rushing past the projectile, would render the gun worse than worthless. The gases would rush through the grooves in in which the balls are placed, and through the clearance space between projectile and gun, burning out the balls and the inner tube only less rapidly than streams of boiling water would cut channels in a block of ice.

That such a delusion as the Cullen ball-bearing gun should have been given publicity to such an extent in the public press, leads us to think that either the journals in question were very hard up for matter, or that the "military expert" must have been enjoying a temporary leave of absence.

A FRENCH TROLLEY AUTOMOBILE.

Of late years various attempts have been made to run an electric carriage by current drawn from an overhead trolley wire. The chief obstacle encountered in using an aerial conductor was the difficulty of holding the trolley wheels in contact with the wires, particularly when the vehicle was rounding curves. The results obtained were not very encouraging. The underrunning trolley wheel carried on a pole, could not be used; for the carriage could not turn out of the way of other vehicles on the road. The substitution of a cable for the pole and the employment of a trolley running over instead of under the wires prove no more successful; for the trolley was merely dragged along by the vehicle. These difficulties seem to have been very ingeniously overcome in a system devised by a French engineer, M. Lombard-Gerin, in which a self-propelling trolley is employed, running along at a speed corresponding with that of the vehicle to which it supplies current.

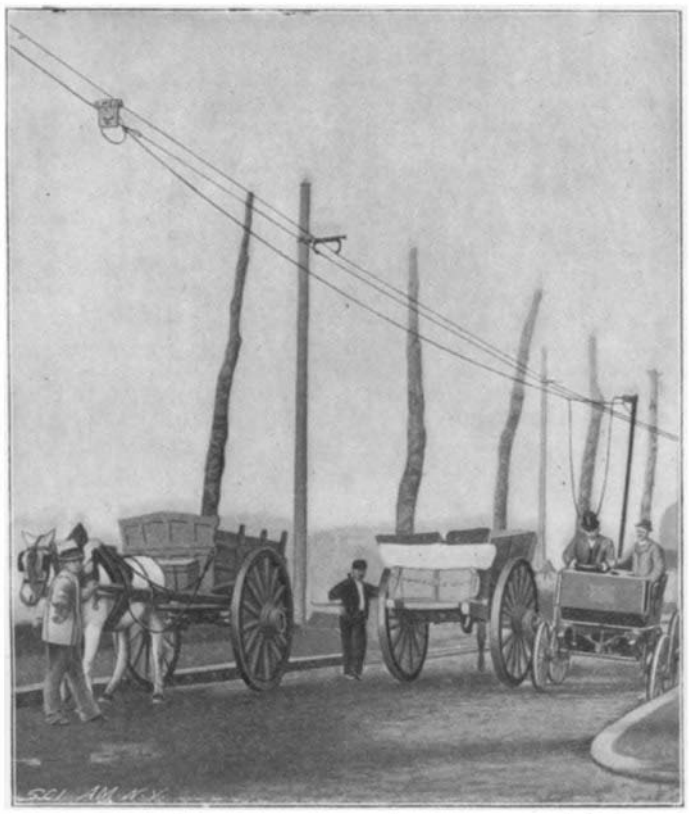
The trolley is driven by a small, three-phase, induction-motor, supplied with current generated by the motor of the vehicle. The trolley-carriage comprises two metal wheels running on the feed and return wires and serving to make the contact. Between these wheels are two insulating, fiber friction-wheels, which engage the motor and thus drive the trolley-carriage. The trolley is driven at a speed slightly greater than that of the vehicle. This small excess of speed is absorbed by the slip of the motor, the slip between the friction wheels and motor, and the slip of the trolley-wheels. Tension on the cable increases the resistance and consequently the slips. The trolley-motor is provided with an electro-magnetic friction-brake, actuated by current taken from the trolley-line. The trolley-carriage is elastically suspended by means of springs, the tension of which can be regulated as desired. The cable leading to the vehicle is connected with a double frame on the carriage by a universal joint, which enables it to swing in all directions. The entire trolley-carriage weighs only forty pounds (18 kilos.), for the reason that aluminium is largely used in its construction.

The vehicle-motor is of the continuous current, series wound type. At the side opposite the commutator, the armature carries three rings connected with the winding at three points separated from one another by a distance equal to one-third the angle between two like field poles. The three-phase current generated by the motor flows through three conductors in the flexible cable, directly to the three-phase motor of the trolley-carriage. The speed of the trolley motor depends on the frequency of the three-phase current by which it is actuated; and this frequency in turn depends upon the number of revolutions of the carriage motor. Hence the speeds of the trolley and vehicle motors are practically synchronous; and the trolley carriage automatically regulates the rate of its motion to that of the vehicle.

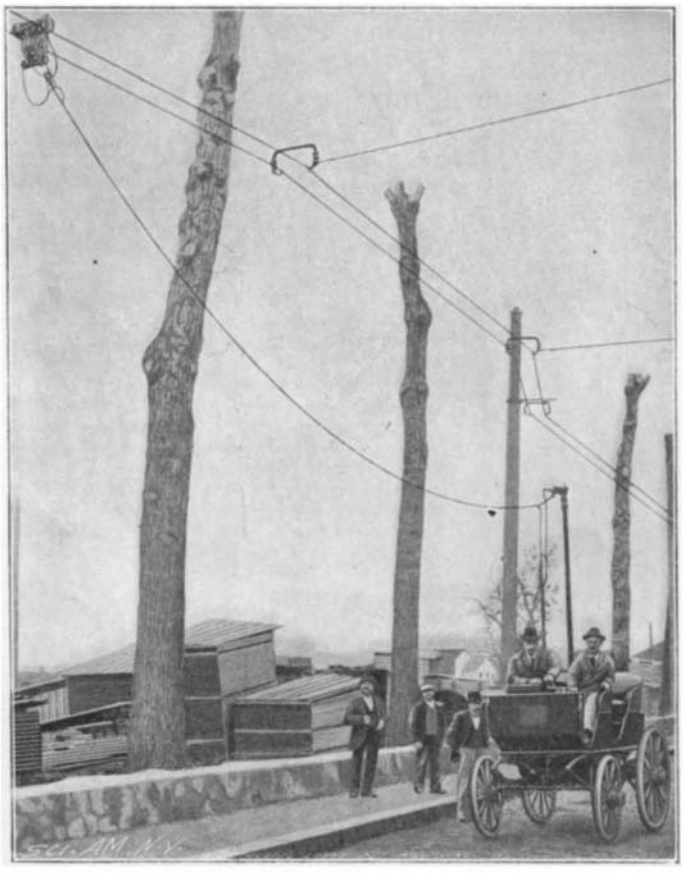
The flexible cable is composed of six conductors.

THE AUTOMOTOR TROLLEY.

Two wires of large cross section serve the purpose of conducting the overhead current to the motor of the vehicle. Three smaller wires supply the trolley-motor with the triple-phase current generated by the automobile-motor, and one small wire connected with a pedal in the carriage serves to throw the magnets of the trolley-motor brake into the circuit of the main line. The brake is used when the trolley is running on a steep incline of the wire. The carriage is not essentially different from the ordinary electromobile.



TROLLEY-AUTOMOBILE PASSING VEHICLES ON THE ROAD.



AUTOMOBILE FED BY AUTOMOTOR TROLLEY.

It is provided with a pole which carries at its extremity a junction-box for the reception of the cable. The boxes of the carriages on the line being similar and interchangeable, it is possible for vehicles running in opposite directions to exchange their cables and continue their journey. To permit the trolley to move in either direction a pole-changing switch forms part of the three-phase circuit, so that the connections of two of the conductors can be reversed, to change the direction of the motor's rotation.

M. Lombard-Gerin's system has been tried on an experimental line 900 meters in length, on the Quai d'Issy-les-Molineaux along the Seine, just outside of the city of Paris. According to Le Génie Civil, the results of severe tests made on this line were very encouraging.

A Congress on the History of Science.

Among the different congresses to be held in Paris at the time of the Exposition, that devoted to the history of science promises to be one of the most interesting. This is a branch of the general section of comparative history and has been organized with a view of bringing together the persons interested in this subject, to establish a resumé of the history of the leading sciences from antiquity to the present day, and to study the proper methods of increasing the researches founded upon original documents. The organization committee have proposed a certain number of questions to be considered, the intention being not to make an exhaustive study of each, but rather as showing where the support of new documents and researches will be the most desirable. Among these may be mentioned the following: Origin of modern numerals; history of astrology, relating especially to the influence which its doctrines have exercised upon the development of astronomy; history of the establishment of units of measure; ancient mathematical instruments, applied to surveying, astronomy, measure of time, etc.; divers meridians of longitude; establishment of the principles of dynamics; alchemy and chemistry; ancient and modern philosophical and scientific theories; geology and physical geography in antiquity; evolution of anthropology and paleontology; history of medicine and hygiene. Communications may be submitted in the principal languages, and in this case notification should be given before the first of June.

The April Building Edition.

The April issue of the BUILDING EDITION OF THE SCIENTIFIC AMERICAN is one of the finest numbers ever published of this artistic periodical. The colored plate represents a modern residence at Plainfield, N. J A residence at St. Louis, Mo., is illustrated by a number of views showing the exterior and the beautiful interior. The Architectural League exhibition forms the subject of two engravings. Prof. C. F. Holder has an article entitled "The Old Missions of California on the Old King's Highway." It is accompanied by an exquisite full-page group showing four of these interesting old buildings. There is also an unusual collection of moderate priced houses. The literary contents afford good reading.

The Current Supplement.

The current SUPPLEMENT, Number 1266, has many articles of unusual interest. "The Sewerage Problem of the City of Worcester" describes a most important plant which has been in successful operation for some time; it is fully illustrated. "English Artillery in the Transvaal" is a timely article. "Destroyers for the Japanese Navy" is accompanied by illustrations of one of these little vessels making a speed of 31·15 knots. "The Classification of Warships" is a most important article by Frederick P. Jane. "The Bird-Stone Ceremonial" is an abstract of a monograph by Prof. Warren K. Moorehead and is fully illustrated. "Is the Steering of the Modern Screw-propelled Vessel Defective?" is the conclusion of a valuable article by the late Capt. Cornelius W. McKay. "Tooth Powders" gives the method of making them in great detail.

Contents.

(Illustrated articles are marked with an asterisk.)