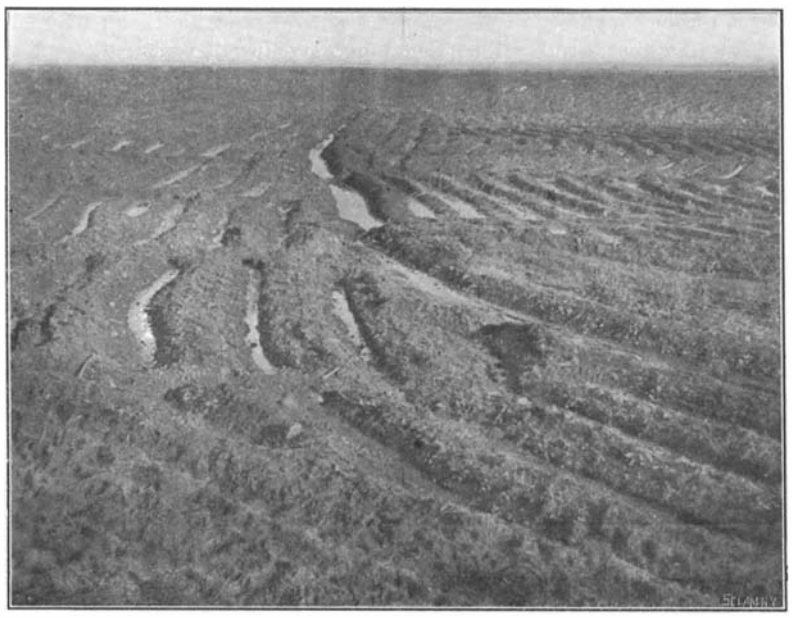
six torpedo-tubes, of which two are below water, the remainder being situated at bow, stern, and on either broadside. The new battleship will be a twin-screw vessel, and is estimated to attain a speed of 18 knots an hour. Belleville boilers, twenty in number, are to be fitted, and will supply steam for two sets of four-cylinder triple-expansion engines, working up to 16,300 horse power. The "Czarevitch" will be fitted with six electric projectors and a complete installation of electric lighting. Electricity, too, will supply the motive power for revolving the turrets and other purposes for which local machinery is required. She is to be fitted as a flagship, and will carry a crew of 700 men.

A SUGAR CANE REAPER WANTED IN HAWAII.

The Hawaiian Sugar Planters' Association have a most important problem to solve, namely, the invention and designing of a reaper for sugar cane in plantation fields. They have set about the problem in an eminently practical manner, offering prizes which aggregate $8,500. A prize—or reward, as the Association terms it—of $2,000 is offered for the best practical design of a machine for reaping the cane. This competition will close on the 30th of June, 1901. The design selected is to become the property of the Association, who may cause the machine to be manufactured for actual trial. A further prize, or reward, of $5,000 is offered for the best working machine that will actually reap cane in the field in a practical manner. This part of the competition will close on December 31, 1901. Should the machine built from the accepted design participate in the actual trials and be successful, the inventor will receive $3,000 in addition to the $2,000 which he has already received in the first part of the competition. If the competition is won by a machine not manufactured by the Association, it will be purchased from the inventor by the Association at the cost price delivered in Honolulu. A further prize of $1,500 is offered for the best design of an apparatus to transport the cane to and load it in railway cars. This competition closes on the 30th of June, 1901. Competitors are required to submit drawings of the machine as a whole, together with full detail-drawings, and only a description where the design is called for. In the second part of the competition, where a machine is called for, competitors will be required to furnish the machines to be experimented with in the field by the board of judges. Should the Hawaiian Sugar Planters' Association accept a design of machine, the payment of the reward will be equivalent to the purchase of all patent rights to such design or machine in the Hawaiian Islands. All communications should be addressed to the secretary of the Association at Honolulu. In order to enable inventors to gain some idea of the practical nature of this problem, we have secured some photographs taken specially to show the conditions which prevail in sugar cane plantations in the islands. The photographs are taken on an irrigated estate, and the figures may be considered as the average.

The canes grow in furrows, 30 feet long and 5 feet apart, center to center. They follow the land contour, and for this reason are sometimes straight and very often curved. At the end of each 30-foot furrow is a water-course 18 inches wide, which supplies one set of furrows. These water-courses are from 50 feet to several hundred feet in length, depending upon the contour of the land. They draw their supply of water from what are termed "level ditches," so called because of their very slight flow. They are from 4 to 5 feet wide and 1½ feet deep, and run through the fields at convenient distances to supply the water-courses. For the operation of any reaper these ditches would be temporarily bridged.

From the furrow-bottoms the canes emerge irregularly. They range in number from 100 to 160 canes per 30-foot furrow, and when ripe are from 14 feet to 20 feet long, with an average stalk diameter of 1.60 inches. The weight of cut cane runs from 70 tons to 105 tons per acre, with an average of 86 tons. They contain 11 per cent to 12 per cent of fiber.



SUGAR CANE FIELD JUST PLANTED, SHOWING FURROWS AND WATERCOURSES.

CANE CUTTERS AT WORK ALONG LINE CUT OUT FOR TRACK.

The canes do not stand upright. Owing to their own weight, they lie along the ground for three-fourths of their length, with a perpendicular upturn for the remaining fourth, surmounted by the green leaves, or "top." After emerging from the soil, they reach out in all directions, forming a sort of mat of interlacing canes below these fairly upright tops. It will, therefore, be noticed that, with furrows 5 feet apart, the canes of above lengths will lie across two furrows, provided their growth be in that direction. The top to be removed consists of a portion of soft cane low in saccharine matter, of green leaves attached at their bases to the stalk, and of unformed leaves in process of growth. Any reaper must of necessity cut canes off where they emerge from the soil and cut off tops in a satisfactory manner.

Concerning the loading device, the illustrations show the condition of the canes. The canes when cut are laid upon the field on top of the loose leaves and tops. This mat of leaves is several inches thick. Canes are cut in lengths about 5 feet long. As far as possible, they are laid straight; owing, however, to the curving of cane stalks, they are frequently laid irregularly. Portable tracks are placed in the fields, running generally parallel to one another, from 150 to 250 feet apart. Cars are run on these tracks in trains of about forty in number, and placed to suit. The car bottom is 2 feet from the ground; its length is 11 feet, and breadth 6 feet. It is assumed that canes on the ground will have to be placed on the conveyer of loader by hand. Any machine for cutting or loading should be operated by either horse power, gasoline, or electricity. Any engine deriving its power from coal or wood, which would either drop cinders or throw sparks, cannot be used in a cane field.

The quantity of cane loaded per day at this particular plantation averages 1,150 tons. For season of 1902 this will be doubled. From this it will be gathered that competitors should design substantial machines, capable of handling cane in large quantities.

It is hoped that American inventors will not be backward in devising an acceptable reaper and loader. We already lead the world in agricultural machinery, and we shall probably continue to do so.

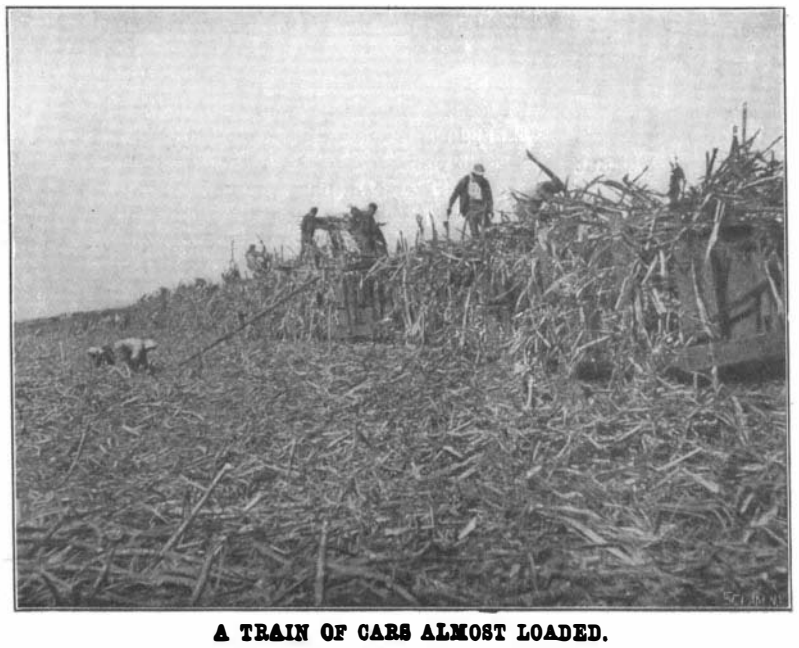
The Becquerel Rays.

A new technical journal, Kirchhoff's Technische Blätter, to be issued within a few days, will contain an interesting article concerning the latest rays.

In 1895, a French chemist discovered rays emanating from the element uranium, which possessed properties similar to the Roentgen rays. They were called Becquerel rays, after their discoverer. But while the discovery of Roentgen aroused great interest in the whole civilized world, leading to radical changes in medical diagnosis, the Becquerel rays were only employed in a very limited way in physical laboratories, and an assertion by the French scientist, Demarcays, that they were not emitted from uranium, but from a new element, made no impression.

Recent experiments by the Berlin High School of Technology have proven this assertion—that a new element is responsible for the Becquerel rays—and the interesting fact has been observed that these rays render almost every transparent substance luminous in the darkness.

These rays make it possible to tell genuine diamonds from artificial ones in the dark. This will prove of great practical importance in testing. The experiments have also resulted in obtaining, for the first time, larger quantities of the new element, which has demonstrated that rays emanating from a larger quantity make the air such a conductor of electricity that it is hoped this property can be utilized in wireless telegraphy. Experiments for this purpose are being made in the Berlin institution, but the deepest secrecy



A TRAIN OF CARS ALMOST LOADED.

LOADING CARS ON THE TEMPORARY TRACK.

is maintained concerning them. It is stated that the results will soon be laid before the Emperor, which seems to indicate that the discovery is regarded as one of great importance.

TRAINING SCHOOL FOR NEW YORK STREET-CAR MOTORMEN.

To the man in the street, the running of a 38-foot electric car of the underground conduit system, at a fairly high rate of speed, through the most crowded and busy streets of the world, is a matter which involves merely the turning of a controller-handle and of a brake-lever in obedience to the signals given by the conductor. But the man on the car is chosen, not because his work is apparently so simple, but because he has proved his fitness to hold his position by an arduous preliminary training. The heavy cars of our large cities cannot be controlled unless the starting apparatus be properly manipulated, unless the brakes are operated in a certain way, and cannot be safely driven through an interminable stream of wagons unless the motormen have no inconsiderable presence of mind and reasonably good judgment.

In order to train its men to think and act with coolness and precision, the Metropolitan Street Railway Company established a training-school some two years ago, in which ambitious recruits were to be systematically taught how to become not only acceptable motormen, but also fairly good electricians, thoroughly familiar with the mechanical and electrical construction of an electric car. The school was the first of its kind ever founded. When it was started by President Vreeland it was scoffed at; but the best proof of its success is to be found in the fact that the street railway-companies of the largest cities have followed the example of the New York company.

Before he is admitted to this training-school, the applicant is examined by a physician. If his eyes be weak, or if he be not sufficiently robust, he never even sees the training-school. The applicant who has successfully passed the physical examination is admitted to the school, and is assigned to one of thirty dummy car-platforms, disposed around the classroom, each fitted with a controller, a brake, a ground-switch, and a fuse-box. He is given a book of rules—his electric-car gospel—which he must learn as thoroughly as he once learned his forgotten catechism and the Ten Commandments. The breaking of one of these rules is a sin for which almost any punishment may be meted out. But, of all offenses, the most heinous is the neglect to remove the handles of the controller upon leaving the car. "Never leave the car-platform for an instant without removing the handles of the controller," is so thoroughly and persistently dinned into the embryo motorman's ears that the rule is followed in the end almost instinctively. Even the men who are tolerated in the school merely because they will not be convinced of their unfitness, never leave the dummy-platform with the controller-handles in place, although as a ruse they may be called by the instructor to his desk to receive some paltry information.

During the few days passed on the dummy platform, the motorman is taught how to start his imaginary car without hurling the passengers from their seats, and how to stop gradually under ordinary circumstances, and suddenly in a case of emergency. The advisability of turning the controller-handle one contact-point at a time, so that the power is applied gradually, is forcibly impressed upon him. In order that he may obey the signals of the conductor, the schoolmaster conveys his orders largely by means of an ordinary car-bell.

When he has learnt the rudiments of his calling, the pupil is taught something of the mysteries of electricity. He is taken to the classroom controller, the casing of which is open, so that all who have eyes may see how it is constructed, and the meaning of each contact-point, each resistance, is clearly explained. He is taught how to cut out the disabled motor of a car from the controller, and how to manipulate the reversing-lever. The terms "multiple" and "series" are defined not only in unmistakable words, but objectively by means of the controller and the motors.

For this purpose the classroom is equipped with an operative skeleton-car, jacked up from the floor so that its wheels may spin with even more freedom than they would on the road. At this period the motorman enters upon the most difficult part of his education. On the road he must be able not only to run his car in a manner which will be a credit to his teaching, but he must also be able to locate open circuits whenever occasion may require. Accidents of all kinds may happen, and the pupil must be able to cope with them before he is graduated. Each man in turn is placed on the platform of the skeleton-car, is instructed practically how to operate the apparatus of which he has charge, and how to locate open circuits on a "dead" car, as it is called in road parlance. If, after having been brought to a stop, the car refuses to move when the current is turned on, the motorman knows that something must be amiss. In accordance with the teaching of the instructor, he orders the conductor—usually another pupil—to switch on the lights. When the glow within the car shows that current is at hand, the motorman steps from his platform and examines the overhead switches on both ends of the car, not, however, without removing his handles. Should the switch-handles be in proper position he inspects the fuse-boxes. If he finds that a fuse has been burnt out he proceeds to the ground-switches to cut off the current, then inserts a new fuse, replaces the ground-switches, mounts his platform again, and starts the car. But if the fuses be intact the motorman is instructed to cut out the motors in succession from the controller in order to ascertain which motor is defective. Should the lamps fail to light he examines the ground-switches. If they be properly set and the headway short, he knows that nothing can be done and that the following car must push him to the terminus. But if the headway be sufficient he continues his inspection. Entering the car he lifts a trap-door and examines the leads of the plow by which the current is fed to the motors. If the circuit be open at the regular connections the leads are replaced in position; but if they be properly connected, then the motorman knows that some injury has been sustained which he cannot repair and that his car must be pushed to the stable. This instruction in making repairs is accompanied by striking illustrations of the consequences of the motorman's breach of the inflexible rule which requires him never to leave the car-platform without removing the controller-handles. Either the instructor or an advanced pupil plays the part of an excitable, forgetful motorman—the man who, when he finds that his car will not start, leaves his controller-handle perhaps on the sixth or ninth point, frantically rushes off to renew a burnt fuse or turn a switch-handle to its proper position, and then suddenly finds himself standing alone with his car speeding away so rapidly that it cannot be easily overtaken.

When a car is disabled by an open circuit and the brakes fail to arrest the car, the motorman is instructed to pull the reversing-lever toward him and then to turn the controller-handle to the sixth point. Thus the motors are placed in multiple and converted into dynamos, sufficient power being generated to stop the car almost immediately. If an emergency stop be necessary, the brake is released, the power is reversed, the controller-handle turned to the first point, and sand applied to the rails. Should a fuse or automatic switch be blown out, the controller-handle is moved to the sixth or ninth point, whereby the car is stopped in the manner already described. The motorman must also learn that, when on a heavy grade, an open circuit requires his attention and that the brake fails to hold his car, he has only to turn the controller-handle to the sixth or ninth point to stop the car, the reversing being left in the forward position since the car is already traveling backward.

The skeleton-car is provided with the usual resistance panels, raised, however, so that they can be readily seen, and fitted with lamps which clearly indicate when the resistance is partially or entirely cut in or out of the circuit. By means of these resistance lamps, the controller, and wiring-charts, the men are taught that with the controller-handle on the first point, the 1,550-volt current furnished by the power-house passes through all the resistance; that on the second point, one-quarter of the resistance is cut out; that on the third point, one-half the resistance is cut out; and that finally when the fifth point is reached, the motors are running in series with all resistance out. The transition from the fifth to the sixth point connects the motors in multiple, the controller-handle passing over three unmarked transition points. The motorman is instructed to make this transition rapidly, so that the motors may sustain no injury from the change to multiple. On the first transition point one-quarter of the resistance is cut in; on the second transition point three-quarters of the resistance are in the circuit, the motors still being in series. On the third transition point, motor No. 2 is dropped out of the circuit. On the sixth point both motors are in multiple with three-quarters of the resistance in the circuit. On the seventh point one-half of the resistance is in the circuit; and on the ninth point, the resistance is out of the circuit, both motors running under full speed in multiple.

The training which the motorman receives on the skeleton-car is supplemented by lectures on the method of crossing avenues and streets through which other cars travel. For classroom demonstration two sets of channel-rails are used, separated any desired distance, to represent the breach in the underground conductor. The schoolmaster constantly reiterates the necessity of shutting off the power at the point indicated by long white marks on the road, and of "floating" across the break. The consequences of turning off the power without sufficient headway are shown by means of a plow used in connection with the channel-rails.

When the applicant has learnt in the school all that he need know, he must pass through a post-graduate course on the road under the guidance of an expert motorman before he is permitted to don the blue uniform which is his diploma, and to mount the platform of his own car. If the road practice prove that he has not fully grasped all that the instructor has impressed upon him, he is either sent back to the classroom, provided there is still hope for him, or summarily dismissed without ever entering the service of the company. The road is the crucial test which the training-school graduate must withstand. There all his faults and all his virtues glaringly exposed are carefully observed by the chief instructor; and there the electric-car career of many an applicant ends.

Our article has been confined to the training of the electric-car motorman. But the school is also equipped with the dummy platform of an air-motor car, and with a cable-grip. The air-motor car is controlled with more difficulty than a locomotive; and for that reason not more than ten per cent of the training school pupils are capable of manipulating its complex starting apparatus. Nowadays the cable-car grip is rarely used. In ten or fifteen years the tall model which now stands in the classroom and towers above everything else will be a relic of the bygone days of the cable-car—an interesting, antique curiosity.

Automobile News.

A long trip through Algeria has been lately made by Messrs. Joseph and Pierre de Crawhez, two prominent chauffeurs. Starting from Algiers, they proceeded toward the south, passing through Boghari, Djelfa and Laghouat, then returning by way of Bou-Saada and Aumale. The distance covered on the tour is about 850 miles, in a region where the roads are but little more than footpaths. The machines were an object of curiosity to the natives, as well as to the Europeans, who saw an automobile visit their region for the first time.

Some additional information has been received as to the operation of electric omnibuses in Berlin. An omnibus line has been lately put in operation to connect the Stettin and Anhalt depots. The Siemens & Halske vehicle with which the company has been making experiments during the last year has proved satisfactory. This omnibus has 12 places interior and 6 on the rear platform. The battery of 44 Pollak elements is placed under the seats and is sufficient for a 10 to 12 mile run. The present line is about 2½ miles long and the trip is made in 25 minutes. The fare for the whole distance is 2½ cents. Each omnibus makes about 60 miles per day; the route has some rather steep grades, reaching 7 per cent. At each end of the line is a central station for charging the batteries. The new system is said to work well and there is some talk of establishing other omnibus lines in different parts of the city.

The annual automobile race, organized by the St. Petersburg Club, had to be abandoned on account of a heavy snowfall, and postponed till a later date. The race was fixed for the 17th of February, and seven competitors were engaged, Messrs. Mazi, Barkett, Henrik and Loginoff in large machines and Sourmetz, Krouspsky and Alexieff in motocycles. The prize was a challenge cup. The day before the race the thermometer marked 18 degrees below zero (Centigrade), and thick whirlwinds of snow filled the air. Four of the competitors declined to run; the other three left the next morning by railroad for Alexandrovskaya, on the Warsaw line, from which the start was to be made. Upon arriving the starter made a tour in his machine and decided that the snow was too deep to permit of running. The jury, composed of Dr. Klimenko, secretary of the club, and two other members, then declared the race off.

The Automobile Club of America now has clubrooms adjacent to Central Park, and a fine library and grill room are provided. The Board of Governors has issued a resolution asking all members to regard the speed regulations. They strongly disapprove of an excessive rate of speed on the public highways, in disregard of the comfort and safety of other users of the common roads, as an injury to the sport and to a great industry. They expect that when members driving automobiles meet a driver of a horse or horses which are restive or frightened, the automobilists, on request or a signal from such driver, will in all cases stop and use every precaution to avoid the possibility of an accident. Any member of the club who shall be found, after a fair hearing, to be guilty of driving at a dangerous or excessive speed on the public highway, or who has disregarded the comfort and safety of other users of the same by failure to stop when requested by the drivers of frightened horses, or who has been guilty of such conduct in the use of automobiles on the highways as shall tend to bring odium or reproach on the organization, shall be duly warned and suspended, and upon the repetition of such offense, shall be expelled from the club. This step taken by the Automobile Club of America will win respect for the organization, which has always done everything in its power to help, not only the sport, but the motor industry as well.