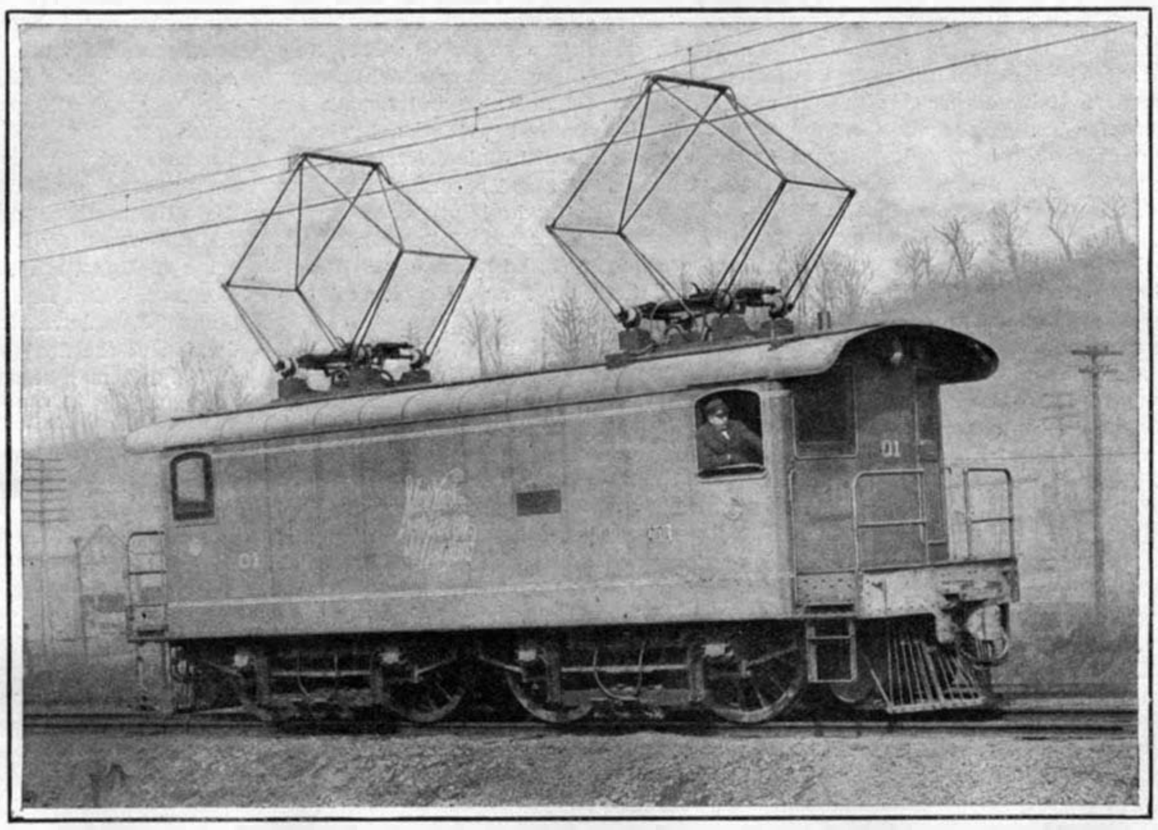
has a length of about 1,500 feet, and can handle from 300 to 600 cords daily. The horse-power required averages from two to three in every hundred feet when the conveyer is traveling at this rate per minute. In one installation of this sort the pulp wood is loaded upon the conveyor from railroad cars, carried to the storage yard, and dumped. At the storage yard the conveyer is depressed to the surface of the ground, and this section is used to supply the mill from the storage yard.

The accompanying photograph shows one of the largest storage yards, which is served by two conveyers, owing to the large quantity of material which is handled. One of these is composed of jointed rods, but like the other referred to it is endless, passing around wheels at each terminal.

Practically all of the conveying machinery used in connection with sawmills, pulp factories, and other woodworking establishments is operated by steam power for convenience, the wheels upon which the endless chains or belts move being belted to shafting or to the flywheel of a special engine. To operate the largest size rarely more than 50 horse-power is needed, and the steam can be furnished from the boiler plant operating the other equipment.



AN ELECTRIC LOCOMOTIVE OF THE NEW YORK, NEW HAVEN AND HARTFORD RAILROAD.

### THE ELECTRIC LOCOMOTIVES OF NEW YORK, NEW HAVEN AND HARTFORD RAILROAD.

Great interest attaches to the new electric locomotives now building for the New York, New Haven, and Hartford Railroad, because of the unusual conditions they are required to meet. An overhead alternating-current trolley system is to be installed on the line from Stamford to Woodlawn. At the latter station the road joins the Harlem branch of the New York Central Railroad, which is to be equipped with a third-rail direct-current system. The locomotives must thus be adapted to operate with both direct and alternating current. The alternating-current line will be fed from a single power station at Riverside, three miles from Stamford and nineteen miles from Woodlawn. Three turbine-driven generators will be used, which are so wound that they will supply either single-phase or three-phase current, and each has a rating of 3,750 kilowatts single-phase, or 5,500 kilowatts three-phase. Current will be supplied to the trolley system under a tension of 11,000 volts; hence no transforming stations will be necessary along the line. Each locomotive, however, will be provided with a pair of transformers to step-down the current to a working pressure. The purpose of having two transformers is to distribute the weight in the locomotive, and also to provide against total disablement of the locomotive in case of injury to one of the transformers. Current will be collected by means of a pair of pantograph-type, bow trolleys. Eight collecting shoes are also provided for the third-rail system, four of the shoes being designed to run under the power rail and the others on the top of the rail, thus allowing for conditions on the New York Central portion of the road. A pair of each type of shoes is mounted at each end of the locomotive.

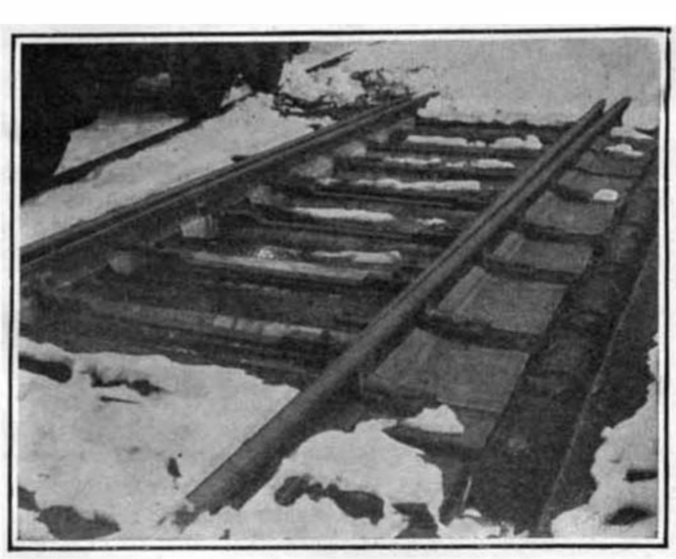
The motors, of which there are four, each have a nominal rating of 250 horse-power, and a continuous capacity of over 200 horse-power, comprising a total of more than 800 horse-power to each locomotive. They are adapted to operate with a voltage of about 235 on alternating current, and from 275 to 300 on direct current. The motors are of the compensating gearless type, and contain some very novel and interesting mechanical features. They are suspended from frames, which fit over the trucks and rest on the journal boxes. Depending from each frame are four bolts provided at their lower ends with coil springs, on which the motor is supported. The armature is not directly connected to the axle of the truck, but is mounted on a quill which passes over the axle, with an all-round clearance of ⅝ inch. On this quill the bearings of the fields are mounted. The quill is formed with a wide flange at each end, and projecting from the face of each flange are a series of pins adapted respectively to engage a series of pockets in the hub of the wheel. Around each pin is a coil spring with its coils progressively eccentric, and these bearing against the sides of the pockets serve to transmit the motive power to the wheels. To prevent wear, steel bushings are fitted over the pins and into the pockets, and between these the eccentric springs operate. This construction provides for a certain amount of vertical and lateral movement, while the motor is centered axially by the compression of the springs between the end walls of the pockets and the flange of the quill. Strong coil springs are fitted into the ends of the pins, and bear against the end walls of the pockets to take up the end play of the motor. In order to prevent the motors from pressing against the wheels when thrown by centrifugal force at curves, they are adapted to bear against rails on the truck frames. This construction has proved an excellent one. The entire locomotive is spring-supported with the exception of the driving wheels, axles, and journal boxes.

A novel feature of the new locomotive is the system of ventilating the motors. In this system the channel beams used in the framework of the car are utilized to provide conduits through which air is pumped by means of a fan in the cab to the motors and transformers. As this air is taken from within the cab, it is fairly dry and clean. The air current, aside from carrying off the heat generated by resistances, also serves to keep the motor free from dust. The locomotives measure 36 feet 4 inches over all, and have a weight of about 85 tons. Tests of one of these locomotives have proved very favorable. A 250-ton train can be handled on a through service with a speed of 60 miles per hour, while heavier trains will be hauled by two or more locomotives coupled together and operated in multiple. In local service a 200-ton train can be operated at an average speed of 26 miles per hour with stops about two miles apart, and making a maximum speed of about 45 miles an hour. The frame, trucks and cab of the locomotive were constructed by the Baldwin Locomotive Company, and the electrical equipment is being installed by the Westinghouse Electric and Manufacturing Company.

A novel use of compressed air is made by some railway companies in the Southern States of America, says the Railway News. When the loads of cotton for export are being taken to the coast, there is always some danger of such highly inflammable material becoming damaged through sparks from the locomotives. To prevent this, the locomotive boilers are filled with compressed air. A train load of several thousand bales of cotton can be hauled by these locomotives at a rate of twelve miles an hour, although no fire whatever is used in working them.

### A NEW METHOD OF HEATING SWITCHES.

The greatest difficulty that railroads have to contend with in winter time is the blocking of switches with snow and ice. While it is a comparatively easy matter to clear the main line of a heavy fall of snow, in the yards even a moderate fall of snow is apt to demoralize the schedule. If the storm is a dry one, the difficulty is confined to shoveling away the snow at the switches. This in itself is no small task in a busy yard, crowded with a maze of converging and crossing lines; but when the snow is wet and then freezes, the difficulty is increased many fold, and serves sometimes to completely tie up and demoralize the system. To overcome these serious conditions, various suggestions have been put forth. Attempts at heating the switches electrically have proved very expensive and quite dangerous, owing to the possibility of short circuits in the network of rails. Steam-heated switches have also met with but little success, due to the danger of condensation, and subsequent freezing, which would entirely block the steam pipes. A new system has recently been developed by Mr. Frank L. Young, of Boston, Mass., which is calculated to overcome the above-mentioned objections. In place of steam, heated oil of a special quality is circulated through pipes placed between the ties. The advantage



THE OIL HEATED SWITCH AFTER A SNOWSTORM.

METHOD OF LAYING THE PIPES FOR THE OIL-HEATED SWITCH.

of oil over steam is that it retains its heat better, and will not chill at 20 to 25 deg. Fah. below zero. Furthermore, if it should chill, it will not expand and burst the pipes as water would when freezing. Steam must be delivered to the pipes at a high temperature, while oil can be circulated without pressure at any degree between 20 deg. below and 400 deg. above zero, and furthermore, the plant can remain idle in very cold weather when it is not required for melting snow. A test of this system was carried on at one of the switches in the yard of the Boston & Maine Railroad at Boston last winter. The plant for heating the oil was located about 350 feet away from the switch, and consisted of a 3-horse-power fire-tube boiler, a gear driver, a screw pump, and a tank. The heater and tank contained the special oil, which was carried to the switch in an underground line of pipe. The oil was forced through the pipes by the pump at any desired temperature, and returned again to be reheated. At no time was it found necessary to heat the oil above 270 deg. At the switch a number of covers or boxes were placed over the pipes, so as to retain the heat and keep the ground in the vicinity in a normal summer condition. The great value of this was that in time of a snowstorm the melted snow would drain off into the ground just as it would during a summer shower, as the ground would be kept from freezing by the heat of the pipes. The past winter furnished no very severe storms which could show the value of this system under extreme conditions. However, on March 15 last, a snow storm occurred which continued all day and a part of the night. From seven to nine inches of snow fell. A wind of between 30 and 40 miles an hour drifted the snow to a depth of two feet or more in many places. The accompanying photograph shows the condition of the switch immediately after this storm. It will be observed that not a particle of snow remained about the switch except in a few places on the ties, which are insulators of heat, nor was there any collection of water to freeze afterward and cause trouble, because the moisture was all drained away into the dry ground. On the average eight inches of snow is equivalent to one inch of rain. Hence it will be evident that even a very heavy fall of snow would be melted and drained off without any serious difficulty.

## THE NATIONAL ACADEMY OF SCIENCES.

(*Continued from page* 363.)

forms had been found in this country. The final paper was on "Recent Solar Investigations," by George E. Hale, who showed with lantern slides the installation of the observatory erected on Mount Wilson in California, and dwelt especially on certain forms of apparatus specially desired for the study of the composition of the sun. In the domain of astro-physics Dr. Hale stands foremost in this country, and exceptional opportunities have been afforded him by grants from the funds of the Carnegie Institution.

On Wednesday the final session of the Academy was devoted to the consideration of a paper on "Some Recent Solar Eclipse Results," by W. W. Campbell and C. D. Perrine, of the Lick Observatory, and was a preliminary presentation of a number of photographs taken during recent eclipses by the authors. The peculiar features of the corona were the subject of their special consideration, but no final decisions were attempted. Prof. M. I. Pupin discussed his work on "Feeble, Rapidly Alternating Magnetization of Iron," and described the difficulties encountered and overcome in the securing of an iron suitable for his special researches. Essentially, he found that the mechanical treatment of an iron had much more to do with accomplishing this result than its chemical composition. By what might be called a slow process of annealing, he believed that the molecules of iron arranged themselves so as to be most satisfactory in yielding a permanent kind of iron.

A paper entitled "The Life History of Pterophryne," by Theodore Gill, was presented by title, and in the absence of the authors, biographical memoirs of Admiral John Rodgers by Asaph Hall and of George P. Marsh by William M. Davis were also presented by title only.

The final paper of the session was "On the Classification of the Cidaridæ," by Alexander Agassiz and H. L. Clark, and was presented by the senior author. He first called attention to the fact that the Cidaridæ represented a variety of sea urchins that had persisted since the Jurassic period, and said that numerous authors had attempted to make a classification of this family, but the results had not been satisfactory. Too much stress had been laid upon special features, such as the spines, which subsequently were found to vary in individuals, thus vitiating the classification. Finally, Mr. Clark had made a complete investigation of the family, and from a study of all of their characters had prepared a classification that was applicable to both the fossil and living members of the family.

The biennial conferment of the Henry Draper gold medal for distinct contributions to astronomical science was this year made to William W. Campbell, director of the Lick Observatory in California. As Dr. Campbell was present at the meeting, the actual presentation was made at the dinner given on Tuesday night by President Agassiz.

Only four persons may be elected during one year to the Academy, and the names undergo the most careful scrutiny even before they reach the electing body. This year three new members were chosen. They were Josiah Royce, professor of the History of Philosophy in Harvard University in Cambridge and famous for his historical and philosophical writings; Benjamin Osgood Peirce, also of Harvard University, where he fills the chair of mathematics and natural philosophy; and William Berryman Scott, who is professor of geology and paleontology in Princeton University. Prof. Scott has long been known as the leader of the Princeton expeditions to the West for paleontological material.

In addition, Prof. Wilhelm Ostwald, of Leipzig, and Prof. H. A. Lorentz, of Leyden, were elected as foreign associates.

The Academy will hold its autumnal meeting in Boston, Mass., beginning on November 20 next.

## THE HENDRICK HUDSON MEMORIAL BRIDGE.

In a little over three years from the present date, New York city proposes to celebrate the tercentennial of the discovery of the Hudson River, by the formal opening of the truly magnificent memorial bridge which forms the subject of our front-page engraving. That the event will have the enthusiastic co-operation of the State through which the Hudson River runs, is certain, while national interest will be as broad as the Union itself in an event which cannot fail to awaken interest throughout the whole world. It is not our purpose in the present article to dwell upon the facts connected with the discovery of the Hudson by the intrepid English navigator. It is enough to state that although he was English by birth, it was from the Dutch that he received the recognition and financial assistance which enabled him to set sail in the little "Half Moon." It was natural that, after the scant encouragement which he had received in his native land he should signalize his appreciation of his royal welcome by the change of his name from Henry to Hendrick. This, according to the best authorities, is the name under which he sailed, and by which the centennial memorial should be known.

The voyage which resulted in the discovery of the Hudson was begun in the early spring of 1609, under the direct orders of the Dutch East India Company. Hudson made land in latitude 44 degrees north, and then sailed south until he discovered the noble river which bears his name. For fifty leagues the adventurous navigators of the "Half Moon" pushed their way up the river, crossing its broad bays, stemming the swift currents where the stately mountains converge in the highlands to narrow its channel, and finding the country "a land as pleasant with grass and flowers and goodly trees as any they had seen."

From a study of the perspective drawing on the front page of this issue, an excellent idea may be gained of the great proportions and architectural and engineering beauty of the proposed memorial bridge. It will span the Harlem River at the point where it connects with the Hudson, and it must be acknowledged that, in view of the topographical and scenic features of the site, no better one could have been found within the limits of Greater New York. Apart from its intrinsic worth as a memorial structure, this lofty viaduct will form an important and greatly-needed link in the parks and driveways, which at present lie scattered over Greater New York, in a somewhat disjointed and unrelated way, and with no adequate means of communication from one to the other. The bridge will have particular value as forming an important extension of the Riverside Drive which reaches from Seventy-second Street, by way of the steel viaduct across Manhattan Valley and the Lafayette Boulevard, to the picturesque heights of Inwood. Here the viaduct will carry the driveway, at an elevation of about 170 feet above the water, to the opposite heights above Spuyten Duyvil, where the automobilist and the driver will find themselves in touch with the fine system of roads which extends up the easterly bank of the Hudson and radiates through picturesque Westchester County.

As a preface to our description of the memorial bridge, we wish to emphasize the fact of its monumental proportions, which are on such a scale as to render it by far the most important memorial structure of its kind ever planned. From abutment to abutment it will have an extreme length of a little under half a mile, or to be exact, 2,500 feet. It will consist of a central steel arch, measuring 825 feet from center to center of end pins, and two massive masonry approaches consisting on each side of a series of arches of from 65 to 90 feet span. The center steel span will be the largest but one in the world, being only 15 feet less in length than the celebrated steel-arch bridge over the Niagara gorge. As herewith shown, the center span is carried on four great trussed arches of the three-hinged type, although if the larger appropriations asked for be granted, it is probable that among other improvements that will be rendered possible, will be the substitution of two-hinged arches for the three-hinged, as here shown—a change which will insure more perfect harmony of the steel span with the architectural features of the whole design. The viaduct throughout will have a width over parapets of 100 feet, and will provide for two 18-foot sidewalks, and a central 60-foot roadway. The main abutments are each pierced by two colossal arches of 65 feet span and no less than 120 feet clear interior height. Beyond these the northerly approach is carried on five arches and the southerly approach on two, the latter each being of 90 feet span.

A notable fact in the design is that the engineer and the architect have thoroughly co-operated in the production of the final plans. Too often, in fact almost entirely, it may be said, there has been no such collaboration in the design of municipal bridges, and some of the most important structures in New York city have suffered greatly in this respect. The architectural treatment is what might be called the modern classical. No attempt has been made at elaborate adornment, the colossal scale of the work rendering such adornment unnecessary and futile. The decorative features have been confined almost entirely to details of a kind that can be seen and appreciated from the driveway itself.

The strictly memorial character of the bridge will be greatly assisted by the fact that at the approach to the viaduct on the Inwood side and in line with the axis of the bridge, there is a natural hill or knoll similar to that on which Claremont is situated at the corresponding entrance to the Riverside viaduct, which will be utilized for the erection of a Hudson memorial. The knoll is about 35 feet in height and the roadway will swing around it on the east and west and meet in the plaza which forms the entrance to the viaduct. This memorial will take the form, probably, of a massive pedestal surmounted by a statue of Hudson, or possibly a model of the historic craft in which he sailed. This feature, however, is not included in the plans which are covered by the present and requested appropriation, but will probably be carried through by popular subscription.

As the tercentennial takes place in a little over three years from the present date, it is evident that a start on the construction of the bridge should be made at once. The city has already appropriated $1,000,000, and a committee of the Board of Estimate, including the Comptroller, and the Presidents of the Boroughs of the Bronx and Manhattan, has recommended that a further appropriation of $2,000,000 be made, thus bringing the total appropriation for the whole structure up to $3,000,000. The proposal has the hearty indorsement of the Mayor, and it is probable that it will be carried through at an early date.

### The Current Supplement.

An article on single-phase locomotives and motor cars in Bavaria and Sweden, by Frank C. Perkins, opens the current SUPPLEMENT, No. 1583. Of technological importance is an article by Felix Lindenberg on the uses of natural asphalt in the arts. Valuable formulæ are given. Mr. James P. Maginnis's third installment on Reservoir, Fountain, and Stylographic Pens is published. The selection of Portland cement for concrete blocks is discussed by Richard K. Meade. Alexander G. McAdie presents the third installment of his treatise on lighting and the electricity of the air. To the man who likes to experiment at home and learn something for himself of the elementary laws of physics, an article on experiments with a lamp chimney will be welcome. Other articles of interest are those on the Renovation of Worn-out Soils, the Mystery of Man's Capacity to Answer a Simple Question, Liquid Crystals, and Heat Insulation.

### Self-Igniting Mantle.

Platinum sponge becomes incandescent on contact with gas and causes its ignition. This phenomenon has given rise to various arrangements for producing the flame direct. MM. Rouxeville and Michaud have patented in France a process in which the addition of any foreign apparatus to the mantle is avoided. They have recourse simply to a mixture in which platinum sponge is the essential ingredient, composed of refractory and adhering substances. Impregnated with this mixture in its upper texture, the mantle has the power of igniting the gas, and of thus becoming incandescent. The stem may also be covered with the composition, and the same result secured.

A statue of Mathias Baldwin, founder of the Baldwin Locomotive Works, has recently been presented to the city of Philadelphia by the officials of the works, and will be placed in Fairmount Park.