SCIENTIFIC AMERICAN
ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) ..... $3.00 a year
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Monthly (Established 1885) ..... 2.50 "
Scientific American Export Edition (Established 1878) ..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, JANUARY 25, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE WRECKED NEW HAVEN CAR IN THE TUNNEL ACCIDENT.

In the thorough discussion of the recent New York Central tunnel accident which is now taking place, there is one most important point which is apparently being overlooked. On the evening of the day of the accident, outgoing passengers through the New York Central yards were attracted by a bonfire which was blazing fiercely on one of the side tracks. The material of this bonfire was the wrecked passenger coach in which seventeen lives had been lost a few hours before. Employés of the railroad were attending the car and seeing to it that every vestige of the woodwork was destroyed. We consider that in view of the enormous value of every scrap of material evidence that might throw light on this calamity, and enable the Coroner's jury and all subsequent investigating bodies to learn the true lessons of the disaster, it is extremely regretable, to say the least, that the company should have deliberately wiped out of existence this car, with the technical evidence that it would have afforded. There were two elements that contributed immediately to the magnitude of the disaster. One, the speed and momentum of the New York Central train; the other, the strength of the New Haven car, and its greater or less ability to offer that resistance to crushing and telescoping which every properly constructed, modern passenger car is supposed to possess in a very large degree.

One of the first things observed when the New York Central engine was backed out of the wrecked car of the New Haven train was the curious fact that the extension smokebox of the locomotive, whose front door had been burst in, was filled full of a substance that looked very much like sawdust. Where did this pulverized wood come from? When the engine drove its cowcatcher under the rear of the New Haven coach, its first action must have been to lift the floor of the coach until the floor and frame of the coach were level with the saddle and smokebox of the engine. The center longitudinal sills were probably struck by the unyielding saddle and tube-plate of the boiler. Had these car sills formed a portion of the thoroughly braced and tie-bolted under-frame of a modern car, they would have shown sufficient strength, one would have thought, to transmit the shock of the colliding engine throughout the whole length of the train. Apparently the shock transmitted was so out of all proportion as to suggest that the car platform crumpled up before the engine like the proverbial eggshell. Was the disintegrated wood that filled the smokebox of the engine and was scattered over the front platform sawdust that had been used as a sound-deadener in the floor, or was it the wreck of the framework? If the latter, and the car timbers were sound, a car-builder would have looked to find splintered instead of pulverized wreckage. It is an interesting point well worthy of investigation.

Just now, a few specimens cut out of these sills and put through a testing machine to determine their quality might have an extremely important bearing in the present investigation. Possibly the railroad companies were careful to save such specimens before they destroyed the car. In any case, we think the custom of burning up a wrecked car immediately after a wreck is greatly to be deprecated.

A significant fact in connection with the question of the behavior of the car is the general testimony of travelers on the New York Central train that they experienced a comparatively light shock at the time of the collision. The crushing in of the enormously strong floor and framing of a modern passenger car should have given the heaviest kind of a shock to the passengers on both trains. It is said that the wrecked car was only twelve years old; but whether this is the case or not, it is sincerely to be hoped that one result of the present disaster will be that the New Haven Railroad will take out of service several old, and therefore necessarily weak passenger cars, which are to be found on many of the local trains that are running to this city.

THE ELECTRIC ELEVATED TRAINS.

The electric train which is now running on regular schedule time on the Second Avenue line of the Elevated Railway Company has served to show that the new system is an unqualified success, and that the claims as to speed, ease of control, and comparative absence of noise, that were made when the change was projected, are fully justified. It is possible to acquire a speed of 15 miles in ten seconds after starting a train, and it is expected to run express trains at 40 miles an hour when the service is more fully developed. The present train consists of two motor cars and a trailer between them; but the ordinary train will consist of five cars, while in rush hours six-car trains will be run, which will be made up of four motor cars and two trailers. Each of the motor cars will be equipped with two 150-horse power motors, thus giving a total horse power of 1,200 for the whole train. The weight of the motors will aggregate 35,000 pounds. The present locomotives weigh 46,000 pounds, or 11,000 pounds more than the combined weight of the eight motors. Altogether 1,800 of the new motors have been ordered to take the place of the 300 locomotives which have hitherto been necessary to serve all the lines of the elevated system. The eight motors of the train will be controlled by one motorman in a cab at the front end of the leading motor car. The movement of the controller in this cab operates magnetic switches on each motor car in the train, and thus every motor is operated simultaneously by the turn of a single lever. Each motor car is equipped with an electrically-driven air compressor for supplying the necessary pressure for the Westinghouse air-brake, with which all the cars will be fitted. This equipment will take the place of the old Eames vacuum brake with which the cars are at present equipped, and it will enable the motorman to bring the trains up to the stations at a higher speed and stop them at shorter distances than is at present possible. There will thus be a gain in time both in accelerating and retarding the train, and the more powerful brake control will, of course, conduce proportionately to the safety of travel.

TARGET PRACTICE IN THE UNITED STATES NAVY.

It is announced on high authority that in the recent quarterly target practice of the North Atlantic Squadron the ammunition employed footed up to an equivalent of $178,000; or, in other words, more ammunition was fired away in gunnery training than was expended in the battle of Manila. It was this prolonged, and even excessive, firing that was maintained by the ships of the fleet that caused certain weaknesses to develop in the deck supports of the battleship "Alabama." The buckling of beams and angle-irons on that vessel was in no sense due, it is declared, to the premature explosion of shells in the 13-inch guns, but was caused by an inherent weakness of structure which only heavy firing was able to develop.

The premature explosion of 13-inch and 6-inch shells on various vessels of the fleet has been followed by a rigid inquiry into the causes of such accidents, and ordnance officers are now satisfied that the trouble has been due to inefficient gas-fitting devices about the shell bases. It was at first feared that the walls of the common shell were not sufficiently strong, and that fragments of the walls were detached from the interior at the instant of firing and projected through the powder charge. Experiments and tests carried out at Indian Head have given every assurance that the shell walls possess requisite strength. Equally gratifying results were reported from the fuse tests, for in order to make sure that the premature bursts did not emanate from the detonators, exhaustive trials were conducted with a view to detecting the slightest weakness, if any existed, in the fuses. The fuses were found beyond a shadow of doubt to be absolutely safe and thoroughly reliable in action.

With the shell walls and fuses proven satisfactory, the only conclusion open pointed to defects in the shell bases, and under hydraulic pressure it was found possible in a number of instances to force water through the screw threads. In firing work the pressures in the chamber of the gun mount as high as 17 tons per square inch, and evidently where water can be forced gases will penetrate under such enormous pressure. The opinion now holds among the ordnance officials that the premature explosions on the "Alabama" were due to gases effecting an entrance into the shells around the base plugs—a defect that can be easily remedied in future shells.

It is estimated that the annual expenditures in target practice in the United States service will very shortly approximate $1,500,000. Prior to the Spanish-American war the heaviest expenditure was in 1897, when nearly $700,000 was used up in gunnery training. Now, as then, the ammunition allowance per man is greater, it is believed, in the American navy than in any service afloat.

Radical changes have been made of late in the forms of targets employed. Prior to 1898 the triangular target supported on spars lashed to three barrels was in common use, whereas to-day a rectangular target built of wire netting and supported on a raft is the popular form. The rectangular target may be taken in tow and a speed of ten knots secured without fear of towing the raft under or capsizing it on short turns, provided always that some additional spars are taken in tow to serve as holders-down. Red, it has been found, is the best color to paint the wire netting, and at considerable distances a shell hole in the target shows up very distinctly.

The splendid qualities of the new American navy smokeless powder make possible the continued and long firing on the part of our guns, something which is not possible with cordite and some other smokeless powders now in use in foreign services. Sub-caliber tubes are employed on United States ships; but generally speaking, target practice is with full charges. With the machine and smaller guns of the secondary battery there is practically no limit to the ammunition expenditure permissible. A limit is fixed in the heavy guns, but from what can be learned the greatest liberality seems to exist, and some of our commanders are complaining of lack of ammunition. Very recently the cordite ammunition purchased in England for the batteries of the cruisers "Albany" and "New Orleans" was condemned and American smokeless powder substituted. No particular fault was found with the cordite, except that it did not stand up to the work as well as American powder. It is estimated that a 6-inch gun using cordite will lose its accuracy entirely after 175 shots, provided initial velocities of 2,700 foot-seconds be imparted. To prolong the lives of their guns the English are keeping the muzzle velocities of the majority of their guns under 2,500 foot-seconds. In the American service 2,800 and 2,900 foot-seconds service initial velocities will be used on the new guns, and the life of a 6-inch American navy weapon can only be conjectured, for it has not yet been determined in service.

The methods of selecting gun captains in the American navy is practically the same to-day as before 1898. It is laid down as a hard-and-fast rule that before a man can be advanced to a high number at the gun he must first have demonstrated that he is a first-class shot with the rifle and revolver; in other words, the initial training commences on the small-arm firing range. From No. 3 or 4 at the gun the seaman is advanced when he has made suitable proficiency to second gun captain, and if he is an exceptionally good man he may hope for special and higher training on some gunnery vessel. The work of training gun captains is intrusted at the outset to the divisional officers; but later it may be taken up by special officers detailed to instruct on the gunnery ships. But back of all systems is the imperative demand for ammunition to carry into effect the gunnery instructions, and in this respect the policy of the Navy Department has been to provide an allowance of a most liberal sort.

The fact should not be overlooked that our new smokeless powder is not as light in weight as cordite and some other foreign powders and we are, therefore, compelled to carry more dead weight of ammunition than English ships. This fact necessitates greater magazine room, and some slight disadvantage in loading rapidly, but these handicaps are far outweighed by other considerations of greater importance which are all in our favor.

A NEW TRADE ROUTE TO PERSIA.

A new trade route to Persia, via Nushki and Seistan has been opened. Hitherto the trade of Persia has been controlled through three main entries, namely, through Caucasia and Transcaspia in the north, and through the Persian Gulf in the south. The two northern entries are entirely under the control of Russia, while England has always been a predominant power in the Persian Gulf. If, however, the Eastern markets require English goods they have to be carried by caravan across the Dashtidut. This places goods entering Persia from Askabad, which is only 150 miles from Meshed, in a predominant position in Khorassan, which has for centuries been one of the richest provinces of Persia. It is this country, which the Nushki-Seistan route is to feed with Anglo-Indian goods. The Indian railway only reaches as far as Quetta, from which place Nushki is 96 miles distant, and though the country between these two places has been surveyed, at present all caravans start from Quetta, in order to be in communication with the railway. The country between Nushki and Seistan is an absolute desert. The camel grazing is excellent for the whole of the way. Robat is the last British post, and the distance can be accomplished in eighteen marches—5 to Dalbindin, 3 to Merui, and 10 to Robat. As far as Dalbindin the water supply is excellent, and sweet water is obtainable on the present route to Merui. Between Nushki and Dalbindin mud bungalows are being erected at every stage, but from Dal-

bindin onward accommodation is at present only to be found in the thanas, or small forts, except at Merui and Robat, where bungalows are already built. From Robat to the Kuh-i-malik Siah, the point of junction of Baluchistan, Afghanistan and Persia, is only half a march. From Robat it is five marches to Pushtee Das, and from thence extends a difficult journey to Nasirabad, where a British Consulate was first established in January, 1899. From Nasirabad the route is to Birjand, thence to Meshed. On this latter section the country is most fertile, villages full of orchards, rich with fruit, being passed on the way. The bazaar at Meshed is at present full of Russian goods—a fact due to the short distance separating Meshed from Askabad, from which place there is direct communication with Europe. In addition to this advantage, Russia gives large bounties to her subjects in Persia, which not only cover the cost of freight, but leave a little profit for the merchant besides. The only British business interests are at present represented by a branch of the Imperial Bank of Persia, a wool buyer for a large firm. English goods, however, are rapidly gaining influence in the town. With the institution of this route, a channel is opened through which English goods can pass with ease into Eastern Persia.

THE ANNUAL MEETING OF THE GEOLOGICAL SOCIETY OF AMERICA.

BY EDMUND O. HOVEY.

The Geological Society of America held its fourteenth annual meeting at Rochester, N. Y., from December 31, 1901, to January 2, 1902, as the guest of the University of Rochester. The convention was well attended, considering the distance of the place of meeting from the large centers of geologic work, and attendance on the programme, consisting of thirty-six papers, twenty-six of which were read in full, was well sustained to the end. Aside from the address of the retiring president, Dr. Charles D. Walcott, director of the U. S. Geological Survey, the most popular interest centered in the papers dealing with physiographic geology and illustrated by means of stereopticon views. Several papers on economic geology were on the programme, but most of them were read only by title. The chief interest of such a convention naturally centers about the address of the president. This was delivered on the evening of the first day of the session and Dr. Walcott took for his subject, "The Outlook of the Geologist in America," and discussed at length the work now being done by national and State geologic surveys, universities, colleges, museums and individuals.

In a few instances funds are contributed to defray research expenses in field and laboratory. In some cases the means of publication are provided. In all cases the teachers of geology are permitted or expected to devote a portion of their time to scientific investigations. In a number of instances State surveys are by legal enactment associated with State universities and the geologic survey of Maryland is conducted under the auspices of a university privately endowed.

Then Dr. Walcott took up in detail and described the work being done by all the various institutions and organizations enumerated by classes and then outlined the problems awaiting solution in each of the great subdivisions of the science, laying special stress, however, upon those confronting the student of pre-Cambrian rocks and the worker along the line of economic geology.

The working out of the larger problems of stratigraphy, correlation, oscillations between land and sea, the migrations of faunas, lines of descent, parallel development, etc., are all awaiting the student. The extent of land areas and the vibrations in character, thickness and distribution of the marginal and deep-sea deposits are imperfectly known. Structural and dynamic problems of the most far-reaching importance are awaiting solution. If the principle be accepted that the classification and delimitation of the greater divisions of the Paleozoic, Mesozoic and Cenozoic eras must rest on the broad biological characters of their included faunas and floras and not on local breaks or differences of sedimentation, important problems remain as to where these lines of demarkation shall be drawn in most geologic provinces. As a result of more detailed studies it is often necessary to revise former methods of classifying and defining sedimentary rocks and igneous masses. The scheme of classification and nomenclature which now expresses the conclusions of our science is not satisfactory.

As an indication of the great activity of the present generation of geologists the speaker cited the fact that in 1899 there were printed 21,600 pages on American geology. Of this vast amount, 12,000 pages were published by State and national surveys, 1,700 pages by geologic journals, 2,000 pages by other journals, 500 pages by the Geological Society of America and 5,400 pages by other associations and institutions.

In closing, Dr. Walcott said that he wished to say a word about the training of the men who will probably reap the largest results from the great opportunities in geology that will be offered during the century. The practical economic geologist will undoubtedly receive the largest financial returns, but in this field, the well-balanced man with the broadest, most thorough training will win out as competition becomes more and more keen. In the more purely scientific lines, a broad, general culture should be the ground-work for special geologic training.

A few months' business training will be almost invaluable to any student who aspires to be more than a directed assistant throughout his career. Business method and habit must underlie all successful administrative work, whether it be of a small party or a great survey. It is needless to say that, as in modern business life, character of the highest standard is essential to permanent success and reputation.

To the well-balanced, well-trained student the outlook in geology in America is most encouraging. It is far more so than when I began work with an honored leader in American geology, James Hall, a quarter of a century ago.

During the past year the society lost five fellows by death. Three men were elected to fellowship in the society in connection with this meeting, namely: Ermine C. Case, instructor in geology, etc., in the State Normal School, Milwaukee, Wis.; Arthur G. Leonard, assistant State geologist, Iowa Geological Survey; Charles H. Warren, instructor in geology in the Massachusetts Institute of Technology, Boston, Mass. The new officers for the ensuing year are: President, N. H. Winchell, of Minneapolis, Minn.; first vice-president, S. F. Emmons, of Washington, D. C.; second vice-president, J. C. Branner, Stanford University, Cal. The social side of the meeting was provided by the annual dinner on the evening of January 1, and by a reception on the evening of January 2, by President Rhees and the trustees of the University of Rochester, at which the fellows had an opportunity to meet the leading citizens of Rochester. Abstracts of the principal papers presented at the meeting will be found in the current SUPPLEMENT.

A SCARCITY OF OFFICERS IN THE MERCHANT MARINE.

The rapid increase, of late years, of the United States Navy and the determination to augment the naval forces of the country to an equality with those of European nations is liable to embarrass the merchant marine, which may be confronted with a possible emergency in a lack of material from which subordinate officers for steam and sailing vessels are chosen. This is the case at the present time on the Pacific coast. The scarcity of young seamen is accounted for in the superior attractions of the naval service, which offers a career of possible distinction, financial reward, freedom from drudgery as well as a chance of promotion which the merchant fleet cannot. Times have changed since the efficiency of the country's navy depended upon the supply of seamen which could be drawn at short notice from the merchant fleet; for no matter how efficient a navigator might be, transferred to a modern ironclad he would be of little account for service until after months of industrious training. The distinction between merchant and naval service is so great as to practically make of them two professions.

While the country is fairly entitled to the services of the best trained men available, it ought, at the same time, to encourage and promote, by all means in its power, the supply of educated officers for the commercial marine. The scarcity of this class of men in Western waters arises from the unprecedented growth of commerce in Pacific waters.

The increasing trade of the Territory of Alaska, sure to be increasingly permanent, employs at least 400 vessels, sail and steam, where less than 40 were required four years ago. In the Hawaiian and Philippine Islands commerce is increasing by leaps and bounds, and will before long require hundreds of vessels to accommodate it, while trade with all the ports of all the countries bordering on the Pacific is growing rapidly. All the indications point to an immense augmentation of the national marine. Every shipyard on the coast, from Puget Sound south to San Diego, for three years past has been working at full capacity to execute orders for new ships, and many shipyards of the Atlantic coast have been kept busy in the attempt to supply the Western demand. Though Pacific shipyards have turned out hundreds of vessels, there is apparently no let-up in the demand. The supply of competent officers for the rapidly increasing fleet has been maintained with difficulty. Ship owners of the coast usually rely upon schools of navigation, which are to be found in all the great ports, to supply the subordinate officers, but the competition of the navy, which gives not only an education but subsistence as well to adventurous young men, has reduced the number available for the merchant fleet. A demand has therefore appeared for relaxing or modifying the rule of the United States Board of Supervising Inspectors, which prevents candidates for licenses from applying before the age of twenty-one years. No person is permitted to apply until after having served three years at sea. The English custom of apprentices begins a practical experience at sea at an early age and permits anyone seventeen years of age to make application for a license and to serve if pronounced competent. The mercantile fleet of England is never without a supply of young officers. The custom of the United States inspectors is to require an interval of one year of service before a new license for an advanced grade is granted; but no matter how studious a young seaman might be, it is rare for him to become master before he has reached the age of thirty or thirty-five years.

It is believed that the rules limiting the age of applicants for licenses, which were adopted in 1878, might be modified to the advantage of navigation by the adoption of the English custom, which is followed so closely in other respects by this country. Such a change in the rules regarding the ages of applicants would, it is believed, render available for immediate service a large number of qualified seamen who are well fitted for the first step in rank, but are excluded from advanced positions on account of youth. A change in the rule would at once release a large number of men who have served a three years' novitiate and are competent for more responsible positions; moreover, by an earlier apprenticeship encouragement would be afforded for young men to make seamanship a profession. Should American shipping be subsidized, as now appears to be probable, a very great increase in the number of this country's vessels would quickly follow, and a lack of experienced officers would be disclosed. Such an emergency would be provided for should the English custom of allowing younger men to apply for officers' licenses, provided in other respects the applicant was properly qualified, be adopted.

SUCCESSFUL WIRELESS TELEGRAPHY AT SEA.

On his arrival here a few days ago, Capt. Hogemann, of the steamship "Kaiser Wilhelm der Grosse," told of the success they had had in working the Marconi apparatus on their last outward trip to Southampton in connection with the fast Cunard steamer "Lucania." It appears the operators on each ship were familiar with the peculiarities of the apparatus on each, and the ships were able to hold aerial converse for nearly three days, until they were about halfway across the ocean.

On December 14, 1901, the "Lucania" sailed three hours before the "Kaiser Wilhelm der Grosse;" when the latter passed Sandy Hook and the "Lucania" was sixty miles ahead Saturday afternoon, they began to exchange wireless messages and signals continued throughout the night. At daybreak the next day, Sunday, the "Kaiser" came in sight of the other ship, and at two o'clock P. M. passed her four miles to the southward. During this time twelve special messages were sent by passengers on the "Lucania" to the "Kaiser" for transmission to the wireless station at the Lizard and thence by land wire to the persons in England to whom they were addressed.

Soon after nightfall on Sunday the lights of the ships were not visible to each other. At noon on Monday their messages showed they were forty miles apart. Early that evening the "Kaiser," when off the Banks, ran into a thick fog; later she came into clear weather and sent the following message:

Twenty-five miles east of Banks. Clear weather.

The "Lucania," then sixty miles astern, replied:

Thanks. Am still in thick fog.

Gradually after this the clicking aboard the "Kaiser" grew weaker until the instrument stopped, when the ships were estimated to be eighty-five miles apart.

On the last trip west the "Kaiser" exchanged wireless messages with her sister ship, "Kronprinz Wilhelm," bound east, when in midocean.

Though they did not sight each other, they exchanged messages and ascertained they were about forty miles apart. They kept up communication for about two hours, several messages being sent by passengers.

The messages received by the "Kaiser" on her trip east were duly transmitted ahead of the arrival of the "Lucania," and when within fifty-five miles of her destination she notified the officials when she would arrive.

Such practical illustrations of the utility of the wireless system of telegraphy leave no doubt as to its value in making the navigation of the ocean safer, for it is a sure preventive of collisions at sea in a fog or at night, by reason of the certainty of advance notification between different vessels.

The wire ropes fastened to some of the most dangerous places in the mountains of the Alps, while they form an important safeguard, have been found to present a new danger as well. They act as lightning conductors, and several tourists were stunned during the past summer, but none of the casualities proved fatal.