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 "
American Homes and Gardens .... 3.00 "
Scientific American Export Edition (Established 1878) .... 3.00 "

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, NOVEMBER 25, 1905.

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.

TURBINE TROUBLES.

It is a matter of common remark that the comparative absence of any serious check to the steady development of the steam turbine is one of the most surprising facts in connection with the new prime mover. And yet, we doubt not that if Mr. Parsons shall ever give to the world a detailed history of the years of experimental work which preceded the production of his first successful turbine, it will be found that success was achieved, only after the inventor had trod the usual weary way of repeated experiment, frequent disappointment, and occasional success. It is a mistake to speak of the steam turbine as a perfected invention; for it will be many years before it will be developed to its ultimate limit of efficiency—a point which has undoubtedly been reached already by the reciprocating engine. In some respects the steam turbine is still in the experimental stage; and the wonder of it all is that an engine of an entirely new type should have shown such high efficiency so early in the history of its development.

Not much has been made known as to the difficulties and disappointments that have been encountered in working the crude idea into the practical machine; yet they have been many, and in some cases serious and discouraging. Thus, in the case of a large ocean steamship recently equipped with steam turbines, and placed in the Atlantic service, there has been continuous trouble caused by heavy priming. The water came over in large volume from the boilers, and on its entering the turbine its inertia proved too much for the rapidly revolving blades, and many of them were stripped entirely from the shaft. This trouble occurred to the high-pressure turbines and was so serious as to necessitate the presence of a man continually at the main throttle. Another serious difficulty, which has developed in the larger turbines, is the fracture of the blades due to their outer ends coming in contact with the cylindrical casing. Of course, the instant that they touch they are snapped from the shaft, with the result that things are pretty badly torn up in the turbine. For some time it was impossible to discover the cause of this contact, for the blades are always adjusted with sufficient clearance to avoid any contact. Ultimately, it was found on making micrometer measurements, that the blades had appreciably increased in length. After long and costly experiments the discovery was made that under certain conditions of speed, length of blade and steam pressure, an intense vibration may be developed in the blades which may become so violent as ultimately to stretch the fiber and give it a permanent set. Eventually a means was found of checking this vibration, or at least of reducing it to a point at which there was no overstraining of the metal. We understand that one of the two firms which are building the 75,000-horse-power turbines for the Cunard liners has set apart a special shop for experimental turbine work, and that already over one hundred thousand dollars has been expended in this way.

The next important event in the development of the marine turbine will be the maiden trip of the new Cunard liner "Carmania," which will sail for this port on December 2. This great ship will have turbines of over 21,000 horse-power; they will, therefore, be approximately twice as powerful as any that have been previously built. The experience gained on the "Carmania" will be of great value in the final designs, at least as to details of steam piping, condensers, etc., in the larger ships of 25 knots speed.

EYESIGHT TEST FOR RAILROAD MEN.

We are in receipt of a communication from a locomotive engineer in far-away Australia, asking us to describe the standard tests for eyesight that are now in operation on the principal railroads of the United States. It seems that on the State railroads of New South Wales the standard eyesight test for employes whose occupation renders it necessary for them to give or receive signals, consisted for many years of color tests made under practical working conditions. The tests were made with colored lights at night and colored flags by day, at an approximate distance of 1,000 yards. Our correspondent informs us, however, that during the present year the following method of testing has been adopted: Vision by Snellen's test type, at a distance of 20 feet; Color Sense by Prof. Holmgren's assorted wools and Dr. Williams' testing lantern; and Hearing, by counting the ticking of a ratchet acoumeter at a distance of 20 feet. It seems that a number of the locomotive men who were unable to pass, and were removed from their engines, failed because they were unable to read accurately the smallest type in the Vision test, namely, "type approximately three-eighths of an inch at a distance of twenty feet." Our correspondent claims that as the eye has been trained to sight signals at a distance both by day and night, it is unpractical to expect that eyesight so developed could sight small objects accurately at a short distance.

Railroad men in this country will at once recognize in the description given of the New South Wales new system of tests, the very methods which have become standard on the leading roads of the United States; and it is evident that the management of these roads are dissatisfied with the present system of long-distance tests, and have decided to adopt the more scientific and carefully-thought-out system which we have found to work so well in this country. While we have every sympathy with the locomotive men who have lost their positions as the result of the change, we think it is probable that the government railroads in New South Wales will be materially benefited by the new rule. That their new system is similar to our own is shown by comparison with that used, for instance, on the New York Central Railroad, which includes first a reading test—three-eighths inch type at a distance of twenty feet; secondly, tests for position or form, consisting of models of semaphores placed in various positions at a distance of twenty feet; third, reading test for ordinary text, such as train orders, at an ordinary reading distance; fourth, color sense, which is tested, first in daylight by displaying strands of worsted of over a hundred varieties of color, and having the men name the colors displayed, and second in a darkened room by displaying glasses of different colors in front of a lantern. Finally, the hearing is tested at a distance of twenty feet by having the men note the strokes of an acoumeter, and repeat (conversation test) words given by the examiner. The men are reexamined at the end of three years from the last examination, and also after any accident in which they may have been present, after illness, and before promotion. The system outlined above, with occasional modifications, has been in force for ten or twelve years on most of our leading roads in this country and on some for a longer period than that. Although it has been the subject of some criticism by practical men who, like our Australian correspondent, would prefer a system of tests under working conditions, the American method has given satisfaction to the railroads, and is believed to provide a surer test for the more subtle defects of eyesight.

ROBERT WHITEHEAD AND THE TORPEDO.

It is not often that the name of a single individual becomes so exclusively identified with a great invention as the name of Whitehead has with the submarine torpedo. A parallel case is that of Bessemer and his process of steel manufacture, which for so many decades remained in almost exclusive use in the steel mills of the world. The recent death of Robert Whitehead affords an opportunity to answer the frequently-asked question as to who he was, and how he invented a device which, it is safe to say, has had a greater influence upon the design of modern warships than any single invention of the past century. Robert Whitehead was an English engineer, who, while he was acting as superintendent at the Austrian government works at Fiume, became interested in the attempts of a certain Austrian officer, Capt. Lupius, to design a self-propelled torpedo. The credit for the root idea is due to the Austrian, but until he became associated with Whitehead he was unable to put it into practical shape. Naturally, Whitehead's first operative torpedo was a very crude affair, the speed being something less than 10 knots an hour and the range very limited. The Austrian navy, however, perceived the great potentialities of the device, and adopted the torpedo in 1868. Whitehead devoted himself energetically to its development, and one by one the defects of this wonderful little vessel were remedied, until it was brought up to its present high state of efficiency by the introduction of the Obry steering gear. The latest type of Whitehead torpedo can travel at a speed of 35 knots an hour; it can automatically regulate its own depth and correct its own course; and, under favorable conditions, it will make accurate attack at a range of several thousand yards.

The Whitehead torpedo, we have said, has exercised a greater controlling influence upon naval construction and tactics than perhaps any other single weapon of naval warfare. At certain periods it seems to have almost absolutely dominated naval design, and there has never been a time when its modifying influence has not been strongly felt. It cannot be denied that the torpedo has, at times, been greatly overrated. Indeed, we believe it is being greatly overrated to-day. The experience of the recent war seems to prove that only under exceptional and very favorable conditions can the torpedo get in its blow. In the fleet engagements on the high seas it seems to have been a negligible quantity, and to have exercised very little, if any, influence upon battle formations. Consequently, we think it is unlikely that torpedo tubes will be fitted into future warships. Moreover, torpedo warfare will more and more be confined to work in sheltered seas and within easy reach of a naval base. Strictly speaking, the work done by the torpedo in the battle of the Sea of Japan was of this last-named character, for, on account of the rough sea that was running, the torpedo boats and destroyers were not used in the early stages of the fight, and were not sent out until after the sea had gone down. In the defense of harbors, straits, and inland seas, however, the torpedo will ever remain an invaluable factor, and particularly so if its range and accuracy in disturbed water and against swiftly-moving ships can be brought up to the proper standard.

MODERN PRESERVATION OF RAILROAD TIES.

Within the past twenty-five years the price of all kinds of timber for architectural and structural purposes has advanced nearly 100 per cent, and the burden on the railway, electric lighting, and telephone companies has increased in proportionate ratio. Apparently no satisfactory substitute for wooden ties or poles has been found, and the dependence upon the forests for supplying mature trees is imperative. The planting of large acreages of private forests with quick-growing varieties of trees has been undertaken by a number of the large western railroads, but the experiments are still too young to demonstrate anything of general practical value. Until such systematic reforesting of our lands can be made, the leading railroads and telephone companies must resort to artificial means of prolonging the life of their ties and poles.

The preservative treatment of ties both for the steam and electric roads has been carried on now long enough to indicate the relative value of the different oils and chemicals employed. The experiences of the steam roads have been that treatment of ties is both economical and desirable, and the results secured far more than offset the initial expense. Nearly all of the railroad ties treated are by the zinc-creosote and zinc-chloride processes. Owing to the comparatively low cost of treatment with these materials, the ties can be economically increased in durability from five to ten years. More expensive chemicals, such as sulphate of ammonia and sulphate of aluminium, prolong the life of wood much greater than treatment with zinc chloride, but their higher cost makes the question of profit doubtful.

Few accurate records of the relative value of treated and untreated poles and ties date back prior to 1897. To-day, however, the foremost steam and electric railroads mark their treated and untreated ties and poles to ascertain their relative age of usefulness. On most of the western roads the life of the tie that has been treated is ten years, but a few ties put down in 1885 and treated by the zinc-creosote system, have lasted upward of fifteen years.

The railroads interested in the subject now employ dating nails which are driven in the upper side of every tie treated. These dating nails enable the track foreman to keep an accurate record of the age of every tie taken up. Copper nails are sometimes used for this purpose. The early galvanized and steel dating nails rusted so badly that at the end of two or three years the date was destroyed. However, several roads use steel dating nails galvanized with a coating of zinc. Samples of the nails are first immersed in a standard solution of copper sulphate for one minute, and then removed and washed and wiped dry. This is repeated four or five times at intervals, and if the zinc has been removed or a copper-colored deposit is found on the surface the nails are rejected. In this way dating nails are obtained which will last as long as the ties without having the date rusted away.

Ties used on railroads are subjected to much greater wear and tear than those employed for interurban electric railways, for the traffic is much heavier and more destructive to the wood. But few ties are worn out. Decay ends their years of usefulness first, and if decay could be arrested entirely ordinary ties that last ten years now could be made serviceable for twenty and thirty years on electric lines.

The source of decay or decomposition is in the air and water rather than in the wood itself. Minute animal or vegetable organisms floating in the air or water come in contact with the albuminous substances in the wood. Under favorable conditions of heat and moisture they multiply rapidly and destroy the timber. To prevent this it is necessary that an antiseptic with