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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 re-examined 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 germ-killing properties be applied to the surface of the ties. Moreover, the organic matter composing the cellular tissue of the wood must be sterilized and rendered inert so that the germs can find no nutrition in them. Theoretically, this can be obtained in a number of ways, but owing to the expense of the different processes it is not always profitable to treat poles and ties.

Most of the ties used by the railroads of the country are treated by the zinc-chloride process, but a few have tried the zinc-creosote and the zinc-tannin processes. On the Chicago & Eastern Illinois Railroad about 64 per cent of the red oak ties, numbering 860,000, that were put down in 1899 have been taken out to date. These ties were treated by the zinc-tannin process. It is estimated by the engineers of the railroad, however, that all of the ties of red oak would have been out before this had they not been so treated. The railroad owned its own plant for treating the ties, and the cost of the work for each tie can alone determine whether the experiment was profitable. The fact that all subsequent ties are thus treated before laying indicates that the railroad engineers consider treated ties more economical than untreated.

The Pittsburg, Fort Wayne & Chicago Railway experimented with ties put down in 1892. A number of white oak ties were used without any treatment, and a similar number of tamaracks and hemlocks treated by the zinc-tannin process. All of these ties have been removed except a few of the hemlocks, and they are to be removed this year. But the fact that the tamaracks and hemlocks lasted as long as the white oak ties is a sufficient proof of the value of the treatment. The ordinary life of the hemlock is much shorter than that of white oak, and its cost in New England is much lower also.

The Atchison, Topeka & Santa Fe Railway treats its ties with the zinc-tannin process, and the records show that treated hemlock had an average life of 10.71 years, untreated white oak 10.17 years, and treated tamarack 8.84 years. Improvements in the processes of treating ties have been steadily made since these experiments were begun, and the life of the treated ties is thus considered much longer to-day than formerly; but as it takes from ten to fifteen years to secure reliable data it is impossible to give figures that will show the difference between the old and new methods.

The question of using higher-priced chemicals for treating ties and poles has been repeatedly brought forward, and a number of the roads are carrying on experiments on a small scale to ascertain the economy of the different processes. Unless the life of the ties can be increased considerably the extra cost of the chemicals will render the work unprofitable. Each year gained on every tie, however, represents an enormous economy on the large lines. By bringing the average life of the abundant soft woods up to that of the hard woods by using preservatives of a cheap nature, millions of dollars can annually be saved to the railroads of the country. The question of cost of ties for the different systems is largely a matter of location. In the Southern States, where the long-leaf pine and cypress trees are plentiful, they are used in preference to all other woods for ties, and the important question at issue is to find the most satisfactory and economical method of preserving such soft woods so they will last from ten to fifteen years.

In New England, spruce, hemlock, tamarack, pine, and chestnut trees are most abundantly used, and their relative age of durability is almost in exact proportion to their cost. On the California coast the redwoods are most commonly used, and in the central and prairie States white and red oak, catalpa, tamarack, and hemlock. By treating the softer woods with preservatives most of the roads have succeeded in lengthening their lives so that they can be used almost as satisfactorily as the hard woods. The cultivation of forests of soft woods for railroad ties is an important branch of railroading for the future, for their growth is much more rapid than the hard woods, and if by being treated with chemicals they perform equally good work, the tie problem will be partly solved. Meanwhile, engineers and chemists are busy testing new processes of treatment, and the difficulties now presented in securing ties that will do service for ten to fifteen years are gradually being eliminated.

FUN WITH THE PHONOGRAPH.

BY DEXTER W. ALLIS.

Few owners of the phonograph realize the great versatility of this machine as a source of amusement. By its use the following experiments may be carried out. In addition to the machine itself, a recorder and a few blank records will be needed.

"Speech by Tom Thumb." The machine must be speeded up as high as possible, and the above announcement recorded on a blank in a deep, loud voice. The machine should be quickly slowed down to about eighty revolutions per minute, and the speech or monologue recorded at that speed, care being taken to articulate distinctly. When the blank is full, the reproducer may be substituted for the recorder, and the machine be brought up again to high speed at which the announcement was made. When the record is reproduced at this speed, the result will be the loud voice of the announcement followed by a rapid, pinched-up little voice making the speech.

"A Whistling Duet by John Smith." This startling announcement through the horn would create much surprise.

Put on a blank; and, after the speed is at about 160 revolutions, whistle some popular piece of which you know the second part. When the record is full, set the recorder back to the beginning again without stopping the machine. When the recording point gets to the commencement of the piece, the first part will sound faintly in the recorder, thus giving the cue and the pitch for the second, which should be recorded not quite so loudly as the first.

Several modifications of this experiment will suggest themselves. The first attempt may not be perfectly successful, but that need not be considered a drawback, as a spoiled record can be easily cleaned with a rag and a little kerosene. The rubbing should be lengthwise of the cylinder till the lines are all removed, after which a soft cloth is rubbed around the record to give a polish. Hard or gold molded records may also be cleaned in this way, which fact suggests another amusing trick.

This will call for two records, preferably talking selections, which are exact duplicates. One of these is "doctored" by cleaning off the latter half, the rest being protected by a piece of writing paper wrapped around and secured by an elastic band. On this blank space various remarks should be recorded, which should be very different from those originally there. The good record is to be played through first. While saying that you will repeat it, the second one is quickly substituted in the machine, and of course starts off exactly like the first one. When the "doctored" portion is reached, however, a change will be noticed, but cannot be accounted for by the hearers.

By taking two records of entirely different character, cutting each in two, and putting on a half of one and a half of the other, we can often jump from the sublime to the ridiculous by quickly flipping the reproducer across the gap, from one to the other. With care the thinner half of one of these records may be slipped halfway on, in a reversed position, and when made to run true, will produce everything backward. A curious thing about such records is that the voice one heard in the proper direction is instantly recognized when reversed, but is, of course, unintelligible.

FREDERIC H. BETTS.

In the death of Mr. Betts, which occurred on the 11th instant in this city, a lawyer of unusual capacity and brilliancy, especially versed in patent law, was removed from the ranks of those prominent in its practice.

Mr. Betts was born in Newburg, N. Y., in 1843, was graduated from Yale University in 1864, and was admitted to the Bar from Columbia College in 1866. It was shortly after this that he became acquainted with Mr. Alfred E. Beach, then one of the proprietors of the Scientific American, who suggested to Mr. Betts the advisability of taking up the study and practice of the patent law, particularly in its higher aspects before the courts. He followed the suggestion, and soon became prominent and successful in being able clearly to present the salient points of cases committed to his care. During recent years he acted for the American Bell Telephone Company, the Western Union Telegraph Company, the Edison Electric Light Company, and several other prominent corporations.

Mr. Betts was always deeply interested in Yale University. He founded the Betts prize in the Yale Law School, and was for a long period lecturer on patent law in the law department of the university. He was also vice-president of the Yale Alumni Association, and in the eighties was connected with several New York citizens' committees and reform organizations.

In 1869 he married Miss Louise Holbrook, a daughter of John F. Holbrook, of New York. The widow and three children—two sons and a daughter—survive him.

For the last few years Mr. Betts was connected in a legal capacity with the firm of bankers of J. P. Morgan & Co., and was regarded as one of the most prominent lawyers in New York. The funeral services were held on the 14th instant in St. George's Church of this city, of which Mr. Betts was a vestryman. Many prominent persons were in attendance.

Mr. Betts will be remembered for his sterling ability as an expounder of the principles of patent law, and their application in the adjudication of difficult and uncertain cases.

In a contribution to the St. Louis Medical Review, of October 21, Dr. John Zahorsky protests against the fashion of using no cradle, urges the return of the cradle to the nursery and predicts that this useful article of furniture will be in style again before long. He cites a number of authorities to prove that "the soothing, rocking movements of the cradle are positively beneficial," particularly when infants are peevish. "The cradle is one of the best therapeutic agents for a nervous baby or a sick one," says he. "It is easier on the mother and preferable to the modern succedanea, pacifier, or paregoric."

SCIENCE NOTES.

M. Camille Flammarion has been making some experiments at the station for climatologic agriculture of Juvisy, in the suburbs of Paris, to see whether the moon exerts any influence upon the growth of plants, according to the popular opinion. He made different sets of plantings at dates which corresponded to the different phases of the moon, using peas, beets, carrots, potatoes, beans, and many other vegetables of the ordinary kinds. After some experimenting he found that the results which were observed on the growth of the plants were extremely variable, and no fixed rule seemed to govern them. The plants appeared at periods which had no connection with the moon's phases, so that it was impossible to draw any definite conclusions from the first series of experiments. M. Flammarion is to continue his observations on this subject and sooner or later will no doubt have results which will decide this much-disputed point.

Electric traction on the Teltow canal, which is one of the principal canals in Germany, is shortly to be applied on a large scale, in accordance with a programme formerly decided upon. It will be remembered that a number of experiments with different forms of tractors were made along the canal, and these showed that the electric system offered many practical advantages. A large central station for supplying the current has already been erected, and is about completed at present. It already contains a 400-horse-power dynamo and engine group and two large steam turbine and dynamo sets of 700 horse-power each. The station will be prepared to furnish current very shortly. The extensive system of locks will first have an electric system for operating it. The rails for the electric locomotives have been laid along the canal in the eastern section between Grünau and Britz, on both banks. The overhead wires and the poles are being put in place, so that it will not be long before the locomotives will be ready to haul the canal boats.

Some rather remarkable results which have been obtained in a series of researches upon the radiation given off from polonium are mentioned by B. Walter, a German physicist. According to him, the α rays of polonium under certain conditions give rise to a luminescence of the air when passing through it. In this case there seems to be an emission of a certain kind of radiation which has a very pronounced photochemical effect, one whose properties are to be compared with those of the spectrum which is included between the rays $\lambda = 350$ and $\lambda = 290$. This radiation is absorbed by a sheet of aluminium 0.0004 inch thick, but it will pass through a plate of glass 0.006 inch thick. This emission seems to be produced especially in the presence of nitrogen. With hydrogen and oxygen the effect is fifty times less intense. Other researches in the same field bring out some of the oxidizing effects caused by bromide of radium. This action is shown when a tube containing bromide of radium is brought near a solution of iodoform in chloroform. A purple color of the solution is observed in the solution even when it is separated from the radium salt by screens of glass, mica, or cardboard. This chemical action does not result from luminous rays but from the special radiations which can pass through the screens. It seems that the β and the γ rays are the only ones which cause the oxidizing phenomena.

Delegates from all parts of the world attended the recent Congress of World's Economic Expansion which was held at Mons under the patronage of King Leopold II. International expeditions to the North and the South poles were discussed and these projects were adhered to by many of the most eminent explorers such as Arktowski, Nordenskjold, Brune, Nansen, Von Drygalski, Racovitza, Charcot, Cook, Peary, and the Duke of Abruzzi. The congress will thus be called upon to lay the foundation for an international association for the study of the polar regions. Besides this important work, the congress made the projects for two international institutions which will be of great value. The first of these is an international Bureau of Ethnography which will collect the documents and specimens furnished by explorers of all countries and will publish the needed information at intervals. The second project is for an international Bureau of Statistics which will centralize all the documents concerning this field and will thus be able to give very important information. Different conferences are no doubt to be held in the future in order to decide certain questions such as an international definition of tonnage of vessels, which is now measured by different methods, also to regulate the speed of ships during fogs and to decide other questions relating to the marine. The statistical section wishes to hold a conference in order to fix the principles of general statistics and to decide other questions of this nature.