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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.

NEW DEPARTMENT OF THE SCIENTIFIC AMERICAN.

In response to many requests from our readers, we have decided to publish, from time to time, a special department of the SCIENTIFIC AMERICAN devoted exclusively to patents and inventions.

Under this head we shall give the latest news of the day relating to the United States Patent Office; and it will include illustrated notices of recently issued patents, which latter will be selected on account of their interest and promise. There will also be a special section devoted to legal notes, and digests of legal decisions relating to patents and trade marks.

The editors are satisfied that the comprehensive scope of these data, coupled with the publication, weekly, of the index of inventions, will render the new department the most compendious and reliable source of information published on the subject.

FORCED VERSUS NATURAL DRAFT.

The forced draft controversy is still with us, and promises to be a fruitful theme of discussion among marine engineers for many a year to come. No doubt at one time forced draft was a fruitful cause of breakdowns at sea; but that was in a day when the scope and limitations of the system were not well understood. If the doors of a boiler furnace that is being forced under so many inches of air-pressure be suddenly swung open by the fireman, the rush of cold air impinging on the tube sheet will induce severe contraction strains and the tube ends will begin to leak. To-day, however, the modified forced draft which is being used on some of the largest and fastest ships is giving most effective service, and this without any serious increase in the boiler repair bill over what would be expected in boilers fired under natural draft. It is certain that there is a more economical consumption of fuel, and that a higher rate of horse power per ton weight of motive power can be realized. On the other hand, we find that some of the most powerful of the steamship companies are bitterly opposed to forced draft and will not contemplate its use for a moment. Among these may be mentioned the North German Lloyd and the Cunard lines, which, in spite of the brilliant success of the "Deutschland" of the Hamburg-American line, have very little that is good to say of forced draft, even in a modified form. The "Kronprinz," and the huge "Kaiser Wilhelm II." now building for the North German Lloyd, have natural draft, and it is significant that the steamship "Bremen," which was burned a little over a year ago at the Hoboken fire, and has just made her maiden trip to this port after undergoing a thorough reconstruction, has had her old boilers, which were equipped with the Howden forced draft, entirely removed and new and larger boilers operated on the natural draft system installed. Speaking of the latter vessel, it may be quoted as a case of remarkable speed in shipyard work that this great steamer, which was completely gutted at the time of the Hoboken disaster, has within twelve months been towed to Newport News, steamed over to Stettin, been cut in two and lengthened 25 feet, had new boilers and entirely new interior fittings for freight and passengers, and has already completed her maiden trip to this country, steaming, by the way, a good two knots better than her former speed of fourteen knots an hour.

ACCIDENT TO THE 10-INCH BROWN SEGMENTAL WIRE GUN.

Our readers will remember that the 10-inch segmental wire gun, which has been built for the United States army, was found on trial to possess too small a powder chamber for the grade of smokeless powder with which the government tests were being carried on, and that the weapon was returned to the makers for the necessary enlargement of the chamber. The change was made and the gun returned to Sandy Hook to complete its trials. In the first test, with a 575-pound projectile and a charge of 150 pounds of powder, a muzzle velocity of 2,230 feet per second was achieved, and apparently no damage had been done to the gun. In the next round the powder charge was raised to 175 pounds of ntiro-cellulose powder. When the gun was fired the overhang of the steel trunnion jacket at the breech was blown entirely away, carrying with it the breech mechanism. In spite of the fact that part of the energy of the explosion was expended in blowing a mass of metal weighing 2,000 pounds 200 feet to the rear, the projectile, gaged by the indicators, showed a muzzle velocity of 2,364 feet per second. The powder pressure in the chamber at the first shot was 28,700 pounds to the square inch, and it is reasonable to assume that had the breech not been blown away the contract velocity of 2,800 feet per second would have been secured. At the present writing it would seem that the failure does not affect the principle of the gun, which consists in building up the inner tube of overlapping steel plates and wrapping the tube with wire, until the desired initial compression of the tube is secured.

MARCONI TELEGRAPHY ON THE HIGH SEAS.

A recent successful exchange of messages between two vessels of the Cunard Line, when they were passing each other in mid-ocean at a distance estimated at from 50 to 70 miles, must have brought home to a great many of us, once more, a strong sense of the almost weird powers of wireless telegraphy. It furnishes another striking instance of how the wonders of yesterday become the commonplaces of to-day. We well remember, during the "America" Cup contests of two years ago, being in the chart room of the "Grande Duchesse" with Marconi, while the vessel was feeling her way down the Bay enveloped in a dense fog, and how, suddenly, the Morse repeater began to unwind its little strip of dot-and-dash messages, a visible evidence of the fact that fifteen miles away the Marconi operator on the Bennett-Mackay cableship outside Sandy Hook was asking us whether we were tangled up in the fog which he could see hanging over the Upper Bay.

It is all something of an old story now; yet we think the captains of these two ships must have felt just a touch of the old wonderment as they heard themselves accosted far out in mid-Atlantic. Yet, for all we can see, these are but the beginnings of wireless telegraphy.

GAS ENGINE PLANTS.

The use of gas engines in electric plants is one of the interesting features of a paper on "Gas Engines" read by M. Deschamps at the last Congress of Electric Station Syndicates. As early as 1886 the Dessau central station used two gas engines of 60 horse power, and in 1889 the Alimentation Exposition at Cologne was lighted by a dynamo driven by a 4-cylinder 100 horse power gas engine. At the present time a number of large plants are using gas engines. At first the engines were of small power, and in the early stations there was a great number of units and a wide variety of types used. Thus in the Kasan electric plant there are two engines of 50 horse power and six of 80, and in the Saint-Gall station are found one of 150 horse power, one of 100, two of 60, two of 30 and one of 25 horse power. At present the ideas have changed on this point, and stations are laid out on another plan. It is found advisable to have a series of engine and dynamo groups which have as nearly as possible the same power and the same type of machine, allowing the use of interchangeable parts. Thus at Brussels, an up-to-date station, there are six of such groups, of 120 horse power each, and at Valenciennes are installed four groups of 160 horse power. One of the most interesting of the modern stations is that of the city of Bâle, which has its water supply entirely furnished by gas engines, with great economy. This has been running since 1894 with great success, and the city of Bâle has lately decided to use gas engines for the city lighting station, with groups of two dynamos driven by a gas engine. The gas is furnished by generators, using low-grade gas, and piping connects with the city mains, which will be used in case of need. The station has already three such dynamo groups in operation, and is provided for future additions. This disposition renders it easy to vary the energy used according to the different hours of lighting. Another modern station is the Oerlikon plant, which uses monophase alternators in parallel. In this case two gas engines of 140 horse power are used to drive two alternators each.

THE NEW YORK CENTRAL TUNNEL.

The plans for the reconstruction of the New York Central Tunnel beneath Park Avenue, which were recently made public by the company, are distinctly disappointing; for the proposed remedy is, on the face of it, a mere makeshift. The steam locomotives are to be retained, and consequently the noxious gases that are poured forth from every passing train will continue to vitiate the tunnel atmosphere. The company's proposal is to remove the masonry partition walls which separate the two outside tracks from the inside express tracks, and substitute therefor two lines of steel columns. It is claimed that this alteration will permit the gases to escape directly from the engines using the outside track to the openings which already exist above the express tracks. It is true this may prove something of relief to trains that now use the side tunnels, but in just the exact proportion that the side tunnels are relieved, the condition of things will become worse in the center of the tunnel on the main tracks where, at present, in the heat of the summer, travel is scarcely endurable. There is only one way to solve this problem and that is to abolish coal-burning locomotives altogether, and substitute electric traction. The New York Central Company can find plenty of electrical engineers who are prepared to devise a system by which the tunnel, the terminal yard and the train-shed can be operated exclusively by electric power, and in view of the enormously valuable character of the franchises which New York city has granted to the New York Central Company, that corporation should not hesitate for a moment to incur the expense, admittedly large, of putting in an electric installation. The public will never be satisfied with anything short of this, for the reason that nothing less can meet the necessities of the case.

BALLOON AND AUTOMOBILE MATCH.

A rather novel match between a balloon and an automobile occurred not long ago in the neighborhood of Paris. The "Alliance," a balloon of 1,500 cubic yards, started from the gas-works at Reuil, in the suburbs, having on board Maurice Farman and Georges Leys, the well-known chauffeur. At the same time a 12-horse power Panhard automobile, piloted by Marcel Cohen, with four other persons, started to give chase to the balloon. It was thought at first that this would be an easy matter, but the balloon was carried about in so many different directions by the air-currents, that the pursuit became difficult. After covering a distance of 120 miles, the automobile party arrived at the station of La Brosse, but found that the balloon had landed there shortly before them and that the aeronauts had already taken the train for Paris, quite satisfied at having won the match.

RECENT AUTOMOBILE ACCIDENTS.

The frequency with which automobile accidents of a fatal or very serious character are happening is not to be attributed to increasing carelessness among automobilists, but rather to the fact that the pastime is growing in favor, and that with a rapid increase in the number of automobiles, we must look, as in the case of the bicycle, for an increasing chapter of accidents. Without implying that what follows has any special application to the recent accidents near Tuxedo or on Long Island, we wish to draw attention to the fact that a mere acquaintance with the management and control of an automobile under *normal* conditions, does not qualify the owner as an expert under all-round conditions. The mechanical manipulation of an automobile may be learned by any intelligent person, but there are to be considered a thousand-and-one contingencies arising from the accidents of wind and weather, the conditions of the road, as regards its grades, surface, curvature, etc., and also, and most important of all, there are the risks which arise from other traffic in city or country. All these external conditions of automobiling can only be fairly mastered as the result of lengthy experience. Thus, there is the most important question of the condition of the road surface as affecting the steering qualities of the machine. Unless he has been warned to guard against it, or has the good fortune to be an old bicycle rider, the inexperienced automobilist will get into trouble should he endeavor to make moderately sharp turns on wet asphalt, or on a hard road covered with mud of a thoroughly greasy consistency. In any good make of automobile the question of the strength of the parts has been so thoroughly worked out that it is probably a rare occurrence that accidents are attributable to structural weakness. In most cases they are probably due to the craze for extremely high speed which has taken possession, as it was bound to do, of the automobile world. America has entered into the lists of competition for the world's record in speed, and already we understand that a racing machine of the enormous capacity of 125 horse power and a guaranteed speed of 75 miles an hour is about to be built. The question arises what in the world is the owner going to do with this machine when he gets it. There are no roads in this country, not even on Long Island, where such a speed could be attained, except at enormous risk, and we very much question whether the tires of this heavy machine could stand the side-stresses involved in swinging around the ends of a mile trotting track at a gait which is only occasionally reached by the fast-

est express train. Until the owner of an automobile has run his machine over a wide variety of roads, and under many conditions of traffic, he should be content with a speed of 12 to 18 miles an hour, and then as he becomes a more perfect judge of speed and distance it will be time enough for him to open the throttle. As matters are now going we are likely to have the same experience with the automobile as with the bicycle. Unless the restrictions as to speed are imposed accidents will become more frequent as the number of owners increases. Restrictions by law are frequently irksome, and are apt at times to be unreasonable; hence it is to the interest of automobilists as a body to voluntarily keep down speed both in town and country to a safe limit.

THE NEW COAST SIGNAL SERVICE.

BY GEORGE E. WALSH.

Prior to the war with Spain we had practically no coast signal service along either of our extensive sea coasts, and when the war broke out the Navy Department made haste to provide some adequate means of protecting the Atlantic seaboard from unexpected attack. It was one of the creditable operations of the war that the department succeeded within a short time in establishing a signal service from Maine to Florida, which kept every important point guarded. There were fifty signal stations established between these two points, and they were sufficiently close together at important points to prevent the approach of any hostile fleet undiscovered. A large sum of money was spent within a few weeks in perfecting this signal service, and no one outside of the government employés knew how perfectly well the whole Atlantic seaboard was covered.

The abandonment of this intricate and costly service at the close of the war was criticised by many, and an effort was made to induce the department to adopt a permanent coast signal service similar to that maintained by France and England. This, however, would have been an immensely costly outlay of funds, far greater, on account of the great extent of our seacoast, than the amount spent in any European country. The Navy Department, however, carefully worked out a system of coast signal service which to-day is so efficient and inexpensive that it deserves greater praise than it receives. It is maintained as a separate branch of the Navy Department, and in times of peace it has nothing to do except to keep its system in such a state of efficiency that on short notice it can perform valuable work.

When the service established its series of stations along the coast it built fifty portable houses or stations. These frame structures could be erected and taken down on short notice. When the war closed the service was discontinued; but the portable station houses were taken apart and stored at various points near the site of the station. The new service contemplates using these portable signal stations in times of war. Each station house and all the signaling equipment are kept in stock, so that on short notice they can be hurried down by fast freight to their positions and put up within a few hours. Each signal station house is numbered, and a chart of the service shows corresponding numbers along the coast and at what point the portable station house is kept in stock. The coast is divided into districts, and in each district there is a certain number of stations. The cost of storage is very small.

To man these signal stations would require a large force, and in the event of hostilities the navy could ill afford to spare the necessary number of efficient men. Green recruits could not well undertake the work; for the importance of the signal service is too great to be jeopardized by men unfamiliar with it. At the outbreak of the war the signal service included a number of men trained for the work, and volunteers were immediately enlisted and trained by the veterans. By these emergency measures the coast was in time carefully protected; but the situation at the declaration of hostilities was critical.

To avoid a crisis which might prove disastrous to the country, the Coast Signal Service has perfected a system by which the Naval Militia of the different States will take immediate charge of the signal stations in times of war.. A large force of the Naval Militia along the Atlantic coast is being drilled in signaling, and these men could be drawn upon on a day's notice for effective work. Many of them saw active service in the Signal Service during the war, and they have further increased their skill and efficiency by a thorough course of study and training under the supervision of prominent officers in the navy.

So effective has this system become that naval officers do not hesitate to say that the signal service is ready for any emergency, while the cost in times of peace is trifling. In the event of war word would be sent out to ship the different signal station houses to their respective positions, and the complete equipment would follow. Then the demand would be made upon the State militia officers for signalmen, and they would be hurried to their posts. Thus within a day or two the whole coast could be amply guarded by fifty different signal stations thoroughly equipped for all work and in the hands of competent men.

Each station is supposed to be equipped with a telegraph instrument and every code of signals used by warships and the merchant marine. The signalmen are then able to exchange messages with any approaching ship, no matter of what nationality or from what port of the world. Each station requires five men. There are two experienced signalmen, two expert telegraphers, and a cook. This provides for night and day work, a signalman and a telegrapher being on duty all the time. In times of war the signalmen and telegraph operators are regularly enlisted as petty officers, and the cook as a common seaman. The telegraph operators must be qualified experts, familiar with the signs and codes used by the signal service. The small wooden signal station building is arranged to provide comfortable quarters for these five men, and they would live there night and day in winter and summer should necessity demand it.

In the daytime the signalman would spend his time in the top of his 50-foot signal mast, where, armed with a pair of double lens binoculars, he would scan the seas in all directions. His orders would be to signal every passing craft, whether sailing ship or steamer, and to enter the questions and replies in the logbook. In the daytime the signaling would all be done by means of the International Code signal flags, displayed at the top of the 50-foot mast. In the nighttime the Shroud light or Meyer code of signals would be used. Ordinary coasting ships would not be reported, but merely entered in the logbook.

Each station is connected by private wire with the Navy Department at Washington. In time of war the operator would report immediately to headquarters of the signal district in which the station was located the signaling of any ship or steamer of importance, and responsible officers there would decide whether it was important enough to send on to Washington. It is believed that the United States thus possesses a perfect signal system, held in readiness at all times for immediate work along our Atlantic coast. In the event of a declaration of war, or a threat of hostilities, word would go forth from the Navy Department over the wires, and within twenty-four hours fifty signal stations would go up from Maine to Texas, and expert, well-drilled Naval Militia volunteers would man them. Within forty-eight hours the Navy Department would be in such a position that every vessel along the coast would be reported to it, and the movement of its own warships up and down the coast could be ascertained. Communication with the warships along the coast, would alone, in such an emergency, prove of the utmost value.

HOW TO STUDY AUTUMN LEAVES.

The government's new Bureau of Plant Industry is taking up the problem of how our gorgeous autumnal foliage receives its variegated coloring. That is one object of the investigations which are now being made by Albert F. Woods, lately appointed pathologist and physiologist of the bureau.

To preserve autumn leaves Mr. Woods says the gatherer should immediately lay them flat between two sheets of new blotting paper spread upon a table top and covered by a stack of heavy books. It is essential that all moisture should be pressed out of them. By this simple process they should be dry within three or four hours. So treated they will retain their beautiful color for years, provided they are not exposed to the direct light of the sun. If not thoroughly deprived of their normally large percentage of water they will soon assume a dirty brown tint.

The color of a leaf, said Mr. Woods, in explaining his investigations, is furnished by minute grains of pigment within its cells. What we see in the fresh leaf is not simple green, but a combination of many pigments, which, when mixed, appear as solid green.

Red is one of the color elements of fresh leaves. Reddish coloring matter is usually in liquid form, within the sap contained by the leaf cells. Yellow, another normal color element, when combined with green, is the natural shade of the grains of pigment within each cell. Brown is the normal color of the walls of the cell.

To explain the leaf cell, Mr. Woods says that he would exhibit a very thin rubber ball filled with the white of an egg mixed with water. He would add to this liquid sufficient red dye to dissolve and color the entire solution. He would add also Paris green, whose minute grains will not dissolve. Yellow grains of some powdered substance, likewise insoluble, he would mingle with the green. The rubber ball itself would be brown, corresponding to the normal color of the leaf cell's walls. Holding the ball up to the light, the combination of the colors in its texture and interior substance would be the green tint of plant life.

To demonstrate the autumnal changes in leaf tints he would spread upon a table hundreds of green beads, interspersed with others of brown, yellow, and red. Then he would take out all of one color, then all of another, and so on, the general shade or tint of the entire mass undergoing a change all the while. Just so in the autumn leaf—when any of its elementary colors disappear the general effect of those remaining clustered in any particular area is altered.

If an autumn leaf turns entirely red this tinting is due to the fact that only its red pigment is left. If it is yellow all of the other coloring has been destroyed, except the minute yellow grains. If the leaf turns brown it can be safely diagnosed as dead. All living tints have disappeared, leaving only the brown walls of the cells. The brown leaf is a dingy ruin, within which every spark of life has been extinguished.

"There has long been a controversy as to the cause of the autumn leaf's coloration," said Mr. Woods. "Some botanists have attributed it to frosts. We are finding that light frosts, not sufficient to kill leaves, greatly facilitate their coloration by causing an increase within them of a normal chemical ferment, which attacks the color compounds or color generators in the cells. We are finding that the oxidation of these color compounds by this ferment causes the various shades of color, especially the purples, oranges, etc. The yellows are normally present in the leaf.

"Autumn leaves containing sugar, such as the maples, sumacs, gums, etc., easily oxidize, and thus form the rich reds, purples and violets so beautiful to the eye. That is why these, especially the hard maples, give the most beautiful autumn leaves. Autumnal oak leaves do not attract admiration because they contain much tannin. The oxidation color of tannic acid is dirty brown. Leaves which die quickly never give autumnal colors."

The most gorgeous autumn leaves, according to Mr. Woods, are produced by a long-drawn-out fall, whose days gradually cool from summer heat to winter snow. But if the frost should come early and the weather should be uneven this fall we need not expect the true autumnal splendors. A heavy, sudden and early frost would kill all leaves alike and turn them to a monotonous brown.

Crimson and scarlet autumn leaves, the most beautiful of all, are more abundant in the cooler parts of this country than elsewhere in the world.

European landscape gardeners are coveting the luxuriance of our autumnal foliage and are endeavoring to transplant cuttings of our most vari-colored trees in their own soil. But thus far those trees which produce the rich purples, crimsons and scarlets have firmly maintained a patriotic determination to beautify only the landscape of their native clime.

The East is much more productive of beautiful autumn tints than is the West, according to botanists. Their explanation for this is that the more humid soil of the East has its beneficial effects.

SCIENCE NOTES.

Dr. Calmette, the director of the Paris Pasteur Institute, was bitten by a cobra from which he was extracting the venom. The serum which he discovered undoubtedly saved his life, but after a lapse of three weeks one of his fingers had to be amputated.

Mrs. Anna Edson Taylor, of Auburn, N. Y., went over the Horseshoe Falls of Niagara in a barrel on the afternoon of October 24 and lived. She was in the water twenty-five minutes from the time the barrel was launched. She was severely injured, receiving a bad scalp wound. The harness rigging in the barrel undoubtedly saved her life.

Dr. N. L. Britton, Director in Chief of the Botanical Garden, has visited the Windward Islands, the object being to obtain living tropical plants and seeds for the conservatory collections. The herbarium specimens for the big museum are as complete a collection as can be obtained. The work is a continuation of the botanical expedition to the West Indies and Central America, instituted in 1899, when Messrs. Heller and Henshaw were sent to Porto Rico by means of funds contributed by Mr. Cornelius Vanderbilt. The museum is obtaining large collections from various sources, and the Torrey Botanical Club has presented its entire herbarium, consisting of several thousand specimens from the immediate vicinity of the city, illustrating the wild plants of the metropolitan district.

The post-office at Buenos Ayres has furnished a striking illustration of the value of X-rays in detective work, says The Electrical Review. Jewelers have found that smuggling in registered letters from Europe was very safe, as the government officials could not legally open such letters on suspicion, and it was finally resolved to investigate the evil without violating the law. The X-rays promptly revealed watches, chains, rings, and other valuables in astonishing quantity. This evidence was sufficient for a court order to open the packages, and more than $20,000 of property has been confiscated in a single week.