

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 employes 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 maple, 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.