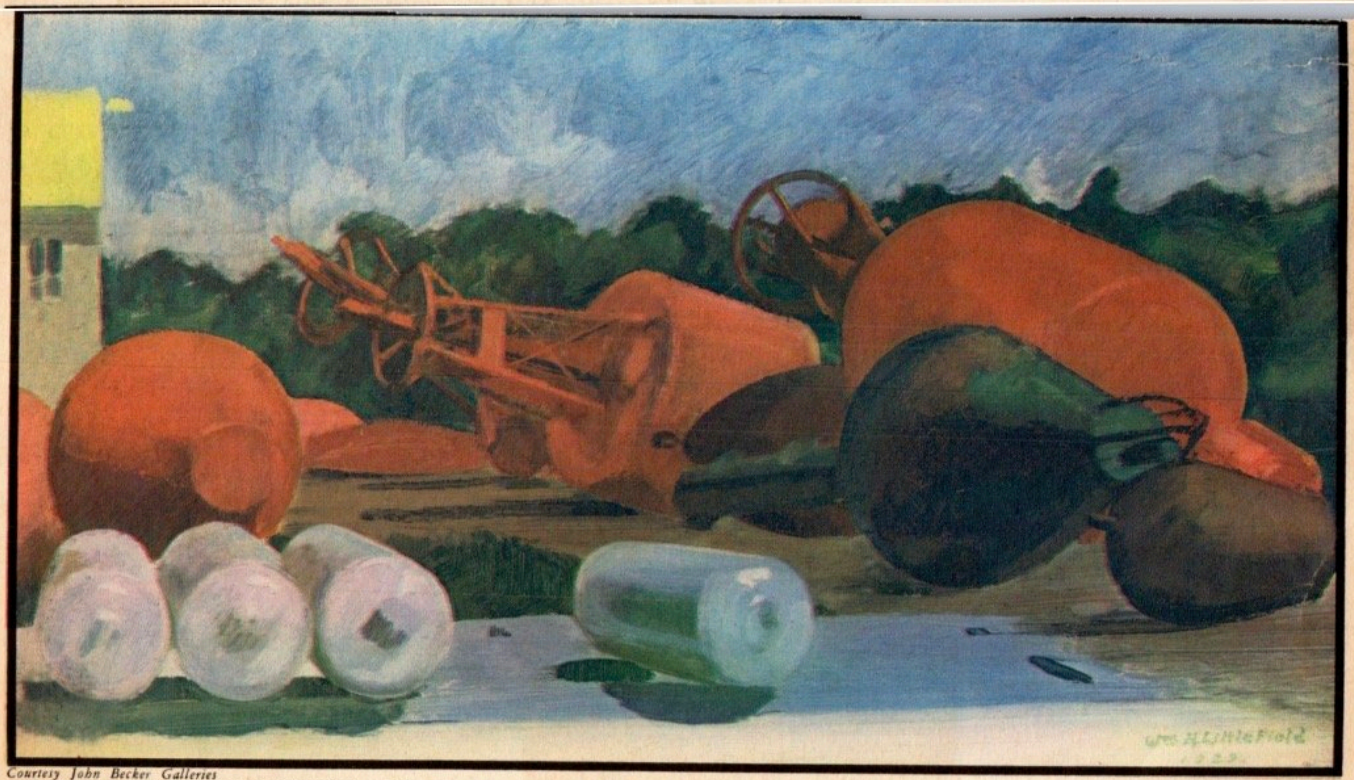
Pillar of Fire

Though the nun and the whistler are sapping its importance, the lighthouse remains one of man's most compelling symbols. Its great names: Stevenson, Dalén, Ida Lewis.

IN THE middle of the Caribbean there are four tiny islands, worth mentioning only because they are on the edge of the main steamship routes between the Gulf ports and the Panama Canal. On each of them is a gaunt tower from which, as the sudden tropic night swoops down, a light begins to flash. When the sun jumps above the horizon once more, the light goes out. Twice a year the U. S. Lighthouse tender *Acacia* drops anchor off these islands and sends ashore a landing party. As they push their way up the beach through hundreds of thousands of nesting birds, they are greeted by no shouts of welcome. No one in sun-bleached clothes runs down to ask for letters, newspapers, tobacco. The only sounds they hear are the whispering of the surf and the shrill cries of sea birds, the only living things they see are the flocks wheeling about their heads, and perhaps a giant turtle or two. They clamber up to the tower, renew its tanks of acetylene gas, make repairs. Then they leave the island to the birds for another six months. And the light flashes steadily through the tropic nights, disappears regularly as daylight comes on.

Along the bleak, storm-swept northern coast of Alaska, where it is hard to get keepers to tend the lights, are many more automatic lights like this, bolted to towers on stark headlands, swinging on buoys in the long Pacific swell. The coast line of the U. S., of the world, is dotted with lonely lights flashing their warnings to ships for months on end without human attention. Off Peaked Hill Bar, Massachusetts, there is one which sent out its light over a twenty-mile radius from April 22, 1913, to October 8, 1914, on a single charge of gas.

Most of these lonely lights are offspring of the great Swedish inventor, Gustaf Dalén. For one thing, most of them are lit by acetylene gas, and it was Dalén who developed for marine use the Claude patents for safely compressing into small containers a half year's supply of this gas. For another, they are most of them intermittently flashing lights, and it was Dalén who applied the flash principle to automatic acetylene lights. Finally, to turn the light on and off, he contrived the Dalén sun valve, one of the simplest and most ingenious of modern inventions. Essentially, it is five rods of copper, four small ones that are brightly polished, and one big one in the center which is made as dull as possible with lampblack. The rays of the rising sun are reflected back from the polished rods, which therefore remain at the same temperature; but they are absorbed by the dull rod, which accordingly grows warm and expands. This expansion turns off the light. When the sun goes



Courtesy John Becker Galleries

A STILL LIFE FOR GARGANTUA: BUOYS LYING UP FOR REPAIRS AT WOODS HOLE, MASSACHUSETTS, AND LOOKING VERY MUCH LIKE GIANT RADISHES AND TURNIPS. THEY WERE PAINTED BY WILLIAM H. LITTLEFIELD

down, the dull rod cools and contracts, turning on the light. The valve can be so delicately adjusted that a heavy thunderstorm or a partial eclipse will turn on the light. The five rods, being of the same metal, are equally affected by heat and cold. It is light alone which causes a difference between their reactions, and thus provides the motive power for the valve.

As a youth, Gustaf Dalén worked on a Swedish farm. Disliking the ordeal of getting up on cold winter mornings, he rigged up a contrivance to mitigate its horrors: this lit the fire under his coffee fifteen minutes before rising time, and then, when the coffee was ready, lit a lamp in his bedroom and rang a loud alarm. A more ambitious invention was a butterfat gauge, which he showed to the famous dairy inventor, De Laval. De Laval advised him to become an engineer, and Dalén took his advice. In the deeply indented, lonely seacoast of his native land, he saw a field for some sort of automatic lighthouse system, and began to experiment, with the results that have already been chronicled. In 1912, he met with disaster and with glory. As he leaned close to the flames in the course of an experiment with acetylene gas, there was a slight explosion. He fell back with a cry of agony, blind. While he was still in a hospital bed, they brought word to him that for his work with marine lights he had been awarded the Nobel Prize.

On the foundation of Dalén's work has risen a great Swedish company, the Aktiebolaget Gasaccumulator (AGA), with which he has been associated from the beginning of his work and of which he is now managing director. As the maker of over 50 per cent of the world's automatic lighthouse equipment, AGA is the dominating company in the field. Over here, there is an American AGA company, privately owned in this country, which works under AGA's patents. It was founded soon after the parent company got the contract for lighting the Panama Canal. In this country, it has a most active competitor: Interflash Signal Corp., also privately owned and also extremely secretive about its business. Unlike the two big railway signal companies, AGA and Interflash are bitter rivals in their competition to furnish the country's marine signals. Interflash claims to supply over 50 per cent of the automatic lighting equipment sold to the U. S. Lighthouse Service, while AGA claims to supply over 80 per cent of this same equipment. The Lighthouse Service declares: "No great amount of material is purchased by us from any one company."

The pillar of fire

THE lighthouse which ornaments the front page of all Scripps-Howard newspapers, and whose black-and-white design, by the way, resembles that of the Dry Tortugas light down on one of the Florida Keys, indicates the place the lighthouse occupies in popular fancy. Although buoys and lightships are coming to assume more importance as aids to navigation, the lighthouse remains the great symbol of a guiding light through storm and darkness, a pillar of fire in the land of Canaan. These tall sentinels are stationed along the coast at greater or lesser intervals, according to the nature of the terrain they protect. Since the north Atlantic coast not only is rock-bound and much indented, but also is the goal of a tremendous amount of shipping, from Cape Hatteras northward, the main or primary lighthouses are placed close enough together so that their arcs of visibility overlap. The Pacific coast, on the other hand, is much more regular in outline, and for long stretches much less frequented by ships; therefore its lighthouses are more widely spaced. The American shore of the Great Lakes is continuously lighted for most of its extent, since traffic along it is extremely heavy.

In one respect, the Scripps-Howard lighthouse is not typical of popular ideas: it is not surrounded by the dashing waves. There are many more lighthouses standing prosaically on dry land than rising sheer from the sea bed, but the wave-swept variety is more exciting and generally more important. The excitement begins with the surveying of the site. Since this is often on some low-lying reef, or some isolated rock which can be approached safely only in a dead calm, the first problem of the engineer is how to land. He may jockey around a rock for months before a day comes when his boat can dart in, land him for a few hastily scribbled dimensions, and then back out again as the waves begin to rise. A mile off the Oregon coast rises Tillamook Rock, less than an acre of craggy rock springing up suddenly from the deep sea, a fearful menace to navigation. The engineer who surveyed it waited six months before he had an opportunity to land, and when he finally succeeded in leaping ashore, he had to leave his instruments behind in the boat. He ran his lines from point to point as quickly as he could, and jumped into the boat as soon as it was able to approach again. The data thus hastily jotted down was all he had to go on in planning the foundations of the tower. A little later, the construction foreman went out to the rock and tried to duplicate the engineer's leap, but his foot slipped, a wave licked him off into the boiling cross currents, and he was never seen again.

Although the thick lens of Tillamook light is 140 feet above the water, it has been shattered by the waves on at least one occasion. The fury of the elements can be experienced nowhere more powerfully than in a wave-swept lighthouse. When the Atlantic grows restless, the waves crashing against the Bishop Rock light tower off the British coast make such an uproar that the keepers must communicate with each other by signs. Often the waves roll clean over the lantern, and once a mighty tongue of water curled up the entire height of the tower and licked off a 550-pound fog bell from the top gallery. Out of the fury of the storm, up from the roaring assaults of wave and wind springs the red flower of heroism. Many laboriously written reports of rescues at sea, of fidelity to the light through hurricane and tempest come into headquarters at Washington every year. They are dull reading to outsiders, but not to Commissioner Putnam. He can read into their matter-of-fact narratives all the drama and bravery omitted by their inarticulate authors.

Since a lighthouse on a reef must withstand the utmost fury of wind and water, lighthouse-building is a matter for the most expert engineering calculations of stress and strain. The most famous workers in this specialized branch of engineering are probably the Stevensons of Scotland, who have produced many famous lighthouses and one famous writer. For well over a century, they have held the romantically titled post of Chief Engineer to the Commissioners of Northern Lights, with jurisdiction over the lighthouses that dot the stormy coasts of Scotland. Thomas Smith, who created the post in 1786, was succeeded by his son-in-law, Robert Stevenson, who built the famous Bell Rock light guarding the reef celebrated in Southey's ballad, *The Inchcape Bell.*

One thing the lighthouse engineer must plot with extreme care is the height of his tower. It will not do for it to rise too high above the water lest it be obscured by fogs when the surface of the sea is clear. The average height is about 125 feet, though some lights rise to 200 and over. A twenty- or thirty-foot tower is often enough on the high cliffs that front the Pacific. Sometimes the cliff is too high, in which case the tower must be built in the sea at its base, as in the case of the famous Eddystone light in the English Channel. In planning towers for the more powerful lights, the curvature of the earth limits the height. Since the curvature increases as the square of the distance, it is slight for moderate distances, but it rapidly grows pronounced at greater distances. Thus a light 100 feet above the water can be seen from a ship fifteen and three-fourths miles distant, but a light 200 feet high can be seen only four and three-fourths miles farther out at sea. The whole business of lights is a complex one. Electricity is used in some lights, but most of them run on kerosene oil, vaporized or straight. The lenses, however, and not the actual lights, are the important thing. These are enormously thick, crystal-clear slabs of hand-molded glass. The bigger ones come from France, which has a near-monopoly on them, for it would not pay more than one or two companies to keep the molds and the highly skilled workmen necessary to make them. Lenses for use on buoys and small, fixed lights are made mostly by Corning Glass Works. From France came also the studies of Fresnel on lighthouse lenses, and the still



Courtesy Mr. and Mrs. L. G. Sheafer

EDWARD HOPPER PAINTS LIGHTHOUSE HILL, NEAR PORTLAND, MAINE. TYPICAL OF MANY SUCH STATIONS ARE THE KEEPER'S VICTORIAN COTTAGE, THE WHITEWASHED TOWER, AND THE WIND-SWEPT HEADLAND

basic system of lenses he evolved. By working out a complex system of ridges and bulges on the lens, he was able to gather together the light rays and focus them in a single thin bar of intensely brilliant light. The tiniest flame of oil, the puniest electric-light bulb, when surrounded by a series of Fresnel's lenses, gave forth a pencil-stream of dazzling light. His work has been carried much further, so that today a light of 400 candlepower is magnified by its lenses into 1,000,000 candlepower. The flashing effect that most major lights give out is obtained by revolving the entire lens, its base resting in a trough of mercury to take up the enormous friction. Most stations have their particular flashing frequency which enables the mariner to distinguish one from another.

Buoys and beacons

AS AN aid to modern navigation, the lighthouse is being superseded, gradually but definitely, by buoys and lightships. For the bigger ships become, the farther away from shore must they keep. And the denser maritime traffic becomes, the more imperative is it that waterways be marked precisely and in detail. The trend in both cases is toward lightships and buoyage systems, which can be placed out in the water right alongside sea lanes. The most elaborate system of shore lighthouses could not take the place of the big red-and-black buoys that mark the edges of the Ambrose Channel, nor could the tallest light tower warn ships away from the vicinity of treacherous Cape Hatteras as effectively as the lightship anchored many miles off shore. The third aid to navigation which is now threatening the supremacy of the lighthouse is the radio beacon (which is simply a distinctive series of dots and dashes sent out from certain lighthouses and lightships at fixed intervals every day), working in conjunction with the radio compass (which is simply an antenna rigged up over the ship's compass and connected to ear phones). By turning the antenna and noting the difference in loudness as the signals come in from near-by radio beacons, the ship's position can be figured out. The radio beacon may in time put out the light of many a tall tower.

Lightships are uninspiring-looking craft. Short, squat, broad of beam, with sides curved inward above the water line, they are as clumsy as lighthouse towers are graceful. They are tethered to their post by enormously heavy chains, which run through a ringed hole in the vessel's snout down to anchors strong enough to hold against the ocean's wildest storms. Painted bright red with huge white letters on their sides, lightships are conspicuous objects even out in the open sea, which does not prevent them from being run into every now and then. Nantucket lightship, first bit of the U. S. to be sighted by liners and generally considered the No. 1 lightship of the Service, has had many harrowing experiences with steamers looming suddenly up out of a fog. Its seven officers and its crew of fifteen go to sleep (or don't) each night knowing they are a floating target

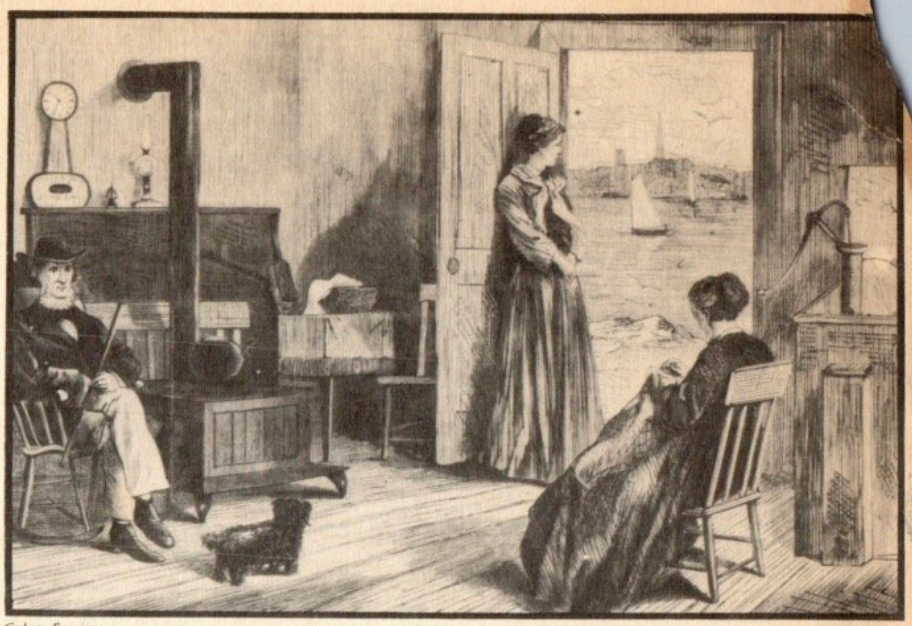
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Pillar of Fire

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towards which is set the course of practically every ship steaming over the broad Atlantic from Europe.

Buoys, even the enormous twelve-ton variety, are not especially impressive when they are in the water. This is because, like icebergs, most of them are submerged. When they are hauled up by the tender's boom, however, the ship careens as the huge bulk of steel incrusted with barnacles emerges from the depths. Spar buoys are particularly amazing: mere ten-foot sticks slanting above the surface become slimy, green telegraph poles when they come up into the air. Of the varieties of buoys, the oddest as to name are the cone-topped nuns. Most ingenious is the whistling buoy. Downward from its body extends a long tube, closed at its upper end by a steel diaphragm pierced by an inlet pipe and an exhaust pipe, the latter with a whistle attached to it. As the buoy rises on the waves, the water in the tube falls and air enters through the inlet valve. When the buoy sinks down again, this air is forced out through the whistle, causing a moan as penetrating as it is lugubrious. Most buoys exist in unadventurous slavery, obediently swinging in the tides of some bay or harbor, hauled out once a year to be cleaned and repainted, then back to their appointed station. Romance, however, may be brought into a buoy's life by an awkward skipper or a severe storm. When a buoy gets free, it often goes on an Odyssey of its own. There was the whistling buoy off North Carolina's Frying Pan shoals which broke loose on November 14, 1923, was caught by the Gulf Stream and borne, moaning sadly at intervals, across the Atlantic to be washed up on the shore of County Cork, Ireland, more than a year later. Another buoy made the same trip from New York harbor in six weeks. And there was a buoy which drifted from San Francisco Bay 1,900 miles down to Hawaii; and the automatic gas buoy which was torn from its moorings off a Florida reef and carried, still burning faithfully, on an erratic eighteen-day trip among the reefs. Wherever a buoy elects to stray, it will probably cause confusion. For buoys mean the same thing in most civilized lands, their significance as to form and color having been agreed on at the Washington Conference in 1889. And they are important everywhere. "Of all the aids to navigation," begins *The Buoyage System of the United States,* an interesting report just issued by the Lighthouse Service, "mariners could least afford to dispense with buoys."



Culver Service

THE UNSUNG HEROINE OF THE LIGHTHOUSE SERVICE

Every schoolchild knows about Barbara Frietchie, Betsy Ross, Molly Pitcher, and the other schoolbook heroines. The Lighthouse Service, however, boasts a heroine as colorful as any of these. Ida Lewis kept the Lime Rock lighthouse in the harbor at Newport (Rhode Island) for thirty-two years. She appears above gazing out to sea from the lighthouse parlor. During her term of duty, she is credited with saving from drowning no fewer than thirteen people—and a sheep. For when three men swamped their boat trying to get a sheep aboard, Ida plunged into the water, rescued all three men, and then went back for the sheep.

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BENEATH the choppy waters of New York Harbor there are sewer pipes, electric cables, a tunnel or two—and sunken ships. Captain Klang, of the U. S. Lighthouse tender *Spruce,* will point out these last to you. These buoys mark the stem and the stern of the newly sunk *Neches;* these, the big Furness Bermuda liner, *Fort Victoria,* which was rammed in the fog in 1929; these, the corpse (soon to be resurrected) of one of the mud dredges which the Army Engineering Corps keeps steadily at work on the harbor's channels. In the Narrows off Brooklyn, the Captain will show you a spar buoy dipping in the tide above a rumrunner sunk two months ago in a battle with the Coast Guard—"A nice craft, too, sweet lines, Liberty motors . . ." And off Rockaway Point, he will direct your attention to the tilted mast and the crazily leaning spars of the harbor's oldest wreck, the Old Dominion ship, S. S. *Princess Ann,* driven ashore one stormy night eleven years ago.

The number of wrecks Captain Klang could point out to you would be considerably greater were it not for the existence of Captain Klang himself, and the branch of the Civil Service he well represents. Consider, for example, the Ambrose Channel. Army engineers scooped it out some years ago with their gray dredge boats, and they still keep it at least forty-five feet deep throughout its length. But it is the U. S. Lighthouse Service which keeps it marked so clearly that a blind man, if he were smart, could bring a ship safely through the Ambrose Channel. And once fairly in it, he would be guided by a constant clangor of bell buoys on his starboard, and by a corresponding moaning of whistling buoys on his port. Those who can see are further aided in the daytime by six foot, white letters AMBROSE on the red hull of the lightship, and by the fact that the starboard buoys are painted red and the port buoys black. At night, they have the powerful light of the lightship, plus automatically flashing acetylene lights (red on the starboard, white on the port) on the buoys, plus a small lighthouse in the lower bay.

Captain Klang's vigilance is one element in the protection which the Lighthouse Service gives our shipping. There is much to protect. The total value of the water-borne commerce of the U. S. last year was $21,500,000,000. To protect this commerce in 1931, Congress has appropriated the sum of $11,657,700. These two figures are impressive witness to the efficiency of the Lighthouse Service. Here are thousands of vessels, bearing within their hulls millions of human lives and many billions of dollars' worth of cargoes, continually leaving and approaching our shores, by day and by night, in fair weather and foul. With its $12,000,000, the Lighthouse Service will pay the salaries of its 5,704 employees, it will build new lighthouses and lightships, and it will keep its lights flashing, its foghorns blowing, its buoys dipping in the tide for another year over 40,580 miles of coast and channel line of the Great Lakes, the Mississippi, Ohio, Missouri, and Yukon rivers, the Atlantic gulf and Pacific coast of the U. S., Alaska, Porto Rico, Hawaii. Certainly $12,000,000 has never gone farther.