few gallons of oil in the manner recommended by the United States Hydrographic Office. The following reports from United States naval vessels show that even aboard men-of-war, with their complete equipment and large crews, the use of oil is regarded as of the greatest value: —

Commander W. C. Wise, U.S.N., commanding the "Juniata," on passage from Hong-Kong to Singapore, used oil on three occasions during a typhoon in the China Sea, Sept. 28 and 29, 1888. "Oil was used, and marked effect shown in lessening amount of water coming on board. . . . A bag containing oil was towed from the weather bow, and decreased the violence of the seas to a marked degree."

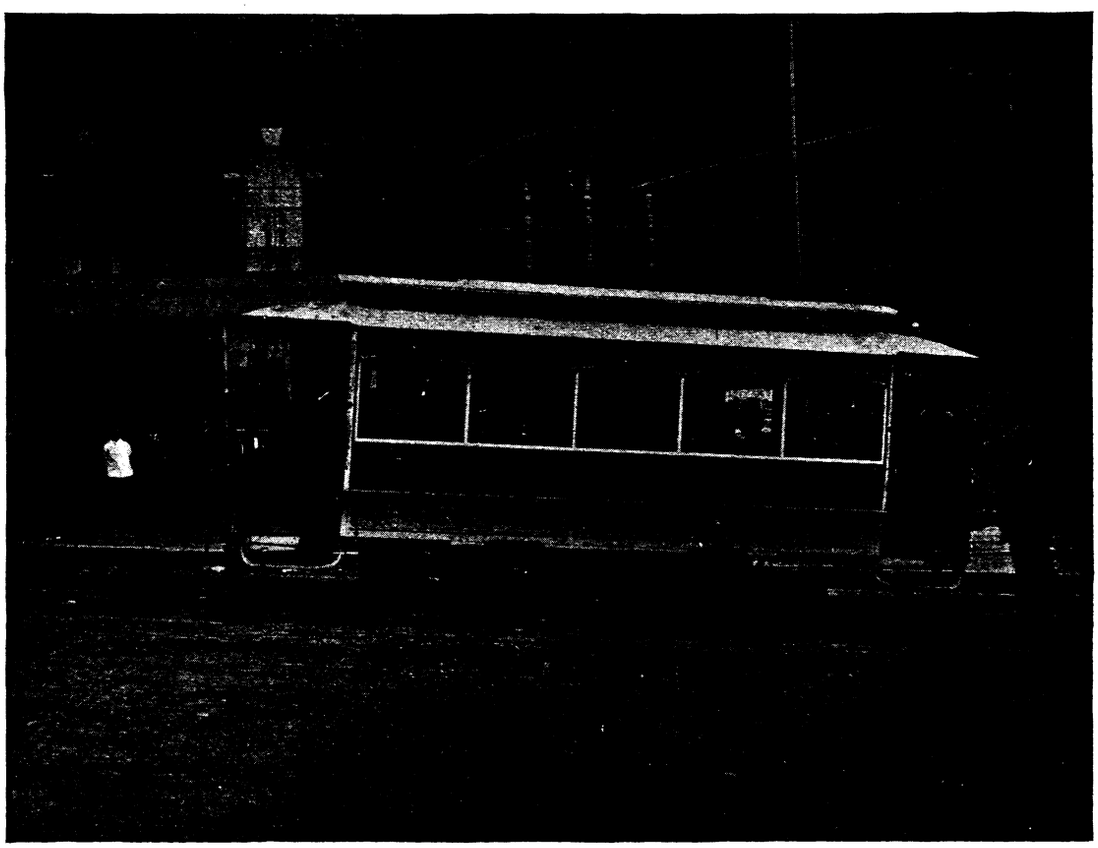
On April 4 and 5, 1889, the "Swatara," Commander John McGowan, U.S.N., was in a hurricane in latitude 41° south, longitude 9° west. On the previous day the wind had veered from west-south-west to north-west, and then to north-north-east. From 9 P.M. to 4 A.M. it blew with a force of 11, and the wind shifted to west, kicking up an ugly confused sea. The ship had been hove to on the port tack early in the morning, with oil-bags over at the fore and mizzen chains. Their effect was such that not a drop of water came on board. April 5, scudding with the wind about two points on the starboard quarter and an oil-bag towing at the starboard fore-chains, "the angry-looking crests simply disappeared, leaving one to wonder what had become of them." Again, on the 8th, "Blowing a living gale of wind, force 11, having backed from north-west to north-north-west. Hove to, and put oil-bags over from fore and mizzen chains, with excellent results. The sea was exceedingly heavy, and the ship rolled deeply; and although considerable water came on board, yet not once did a sea break over the rail. The angry, towering crests of the huge waves disappeared as if by magic."

Lieut. C. F. Norton, U.S.N., of the "Kearsarge," reports that in the storm of the 6th, 7th, and 8th of April, off Hatteras, they used oil with good effect, pouring it through the forward water-closet. At first, olive-oil was used, which did fairly well; but later they used lard-oil, and that gave perfect satisfaction, keeping the water from coming on board. Oil was used a part of two days, while hove to.

Finally, the "Yantic," Commander C. H. Rockwell, U.S.N., encountered a terrific hurricane, May 21, in latitude 38° 35′ north, longitude 68° 30′ west. While on her beam ends, with heavy sea sweeping over her, "oil in large quantities was thrown overboard from the weather bow, and even in that terrible scene its effect was immediately apparent."

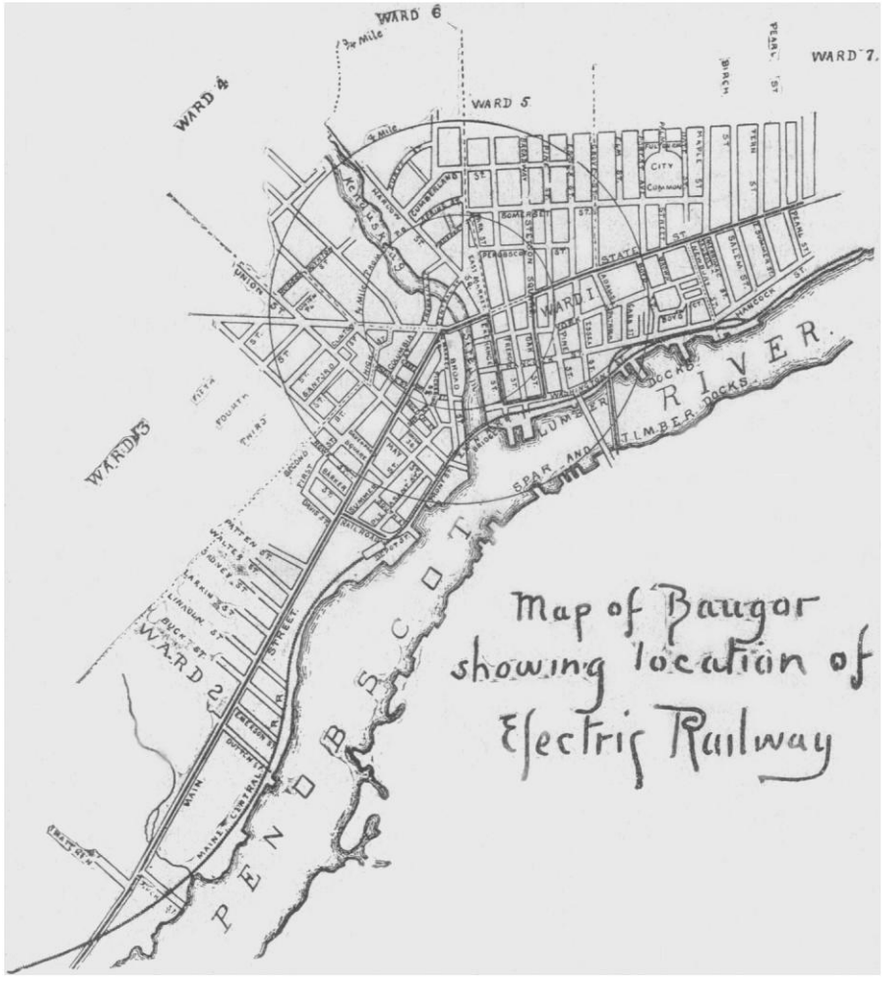
A HISTORY OF HABITATIONS.

THE French have always exhibited a fondness for the study of comparative architecture, and have made themselves masters of a peculiarly interesting portion of art history in which other peoples have scarcely made more than beginnings. For some years the story of the evolution of the dwelling has been known chiefly through "The Story of a House," by M. Viollet-le-Duc, which has been the most accessible, if not the only, work of its kind extant. In the Paris Exhibition of 1878, one of the most interesting features was the "Street of Nations," which was lined with typical specimens of architecture of all lands, and was unquestionably the most complete exhibition of comparative architecture that had been made up to that time. The present exhibition, however, has, thanks to the rare skill and energy of M. Charles Garnier and a body of enthusiastic assistants, an exhibition of comparative architecture that is by far the most elaborate yet attempted. A series of thirty-two edifices have been erected on the Quai d'Orsay, representing the evolution of the dwelling, from the earliest form of a rude breakwind and cave, to the completed residence of the Renaissance. It is an unfortunate fact that much of the material for such a display exists only in a fragmentary or much-scattered form. The dwellings of antiquity are known to us chiefly by meagre descriptions, rough, sketchy carvings in the sculptures, and other data that are quite as apt to mislead as to indicate the right direction. Yet M. Garnier has not been content to accept mere hearsay, nor even to adopt the results of the imagination, but, on the contrary, has



A 7-PER-CENT GRADE ON THE THOMSON-HOUSTON ROAD IN BANGOR, ME.

availed himself of all possible authorities, and as the result has prepared a series of dwellings, which, if not authentic in all their details, are still sufficiently correct to be accepted as the best obtainable, and which are certainly nearer the originals than has been reached by any previous attempts. In designing these edifices, the idea has been to exhibit the actual dwellings of the masses of the people rather than to represent the palaces of the rich and the powerful; and the rule has also been laid down, to represent the most ancient form, where there has been any great deviation in styles, because the more modern variations are more familiar, and have been more frequently reproduced. Both these limitations, admirable in themselves, have added to the difficulty of the task M. Garnier laid out for himself; for the houses of the rich are more frequently described by ancient writers than those of the poor, and



the descriptions of the more ancient forms are necessarily less readily interpreted than those near at hand.

M. Garnier has divided habitations into two great classes, — those of prehistoric time, and those of historic. The former period begins with the appearance of man upon the earth, and comes down to the time when nations, properly so called, were formed, and history begins. The historic period includes two subdivisions: the first relating to those peoples who have contributed to the advancement of civilization; and the second including those who, while leaving characteristic monuments, have stood, as it were, on one side, and not influenced the general growth of culture. The models at Paris are arranged in three great groups under these general heads; but, apart from this classification, there is another, which, while not especially observable in the arrangements of the edifices themselves, is of the highest historical importance. The historic period includes, first, early or primitive civilizations, including the Egyptian, Assyrian, Phœnician, Hebrew, Pelagic, and Etruscan; and, second, the civilizations arising from the Aryan invasions, including the Indians, Persians, Germans, Gauls, Greeks, and Romans. In 395 A.D. the Roman Empire was divided, and the two parts exhibit distinct features of architectural types. In the West the Roman civilization was overthrown by several invasions, all resulting in distinct architectural types. These were the Huns, the Germans and Franks, and, last in point of date, the Scandinavians. After Europe had passed through the convulsions caused by these inroads, we have the civilizations of the Romanesque period, the middle ages, and the Renaissance. In the East other events were shaping the destinies of humanity. The Roman civilization lasted here some ten centuries; but it soon lost its earlier characteristics, and developed into the Byzantine. This was further developed in the Byzantine architecture of the Slavs and the Russians, while the Mohammedan invasions of the Arabs and the Turks soon destroyed its distinctive character. All these developments have been admirably summarized by M. Garnier in the "Guide Historique" of M. Ammann, to the exhibition of dwellings.

The structures begin with a simple breakwind. Then man found that the shelter of the caves was more durable, and finally a rude hut was attempted. Then begins the long series of artificial houses. There is a rude hut supposed to be contemporary with the dolmens. A lake-village, modelled after those of Switzerland, is the most elaborate portion of this group, and corresponds to the age of bronze. The age of iron is represented by a hut modelled after a terra-cotta model found at Lake Albino, near Rome. Then come the dwellings of historical times, beginning with an Egyptian house. This is designed in the style the monuments have familiarized us with. A corridor opens into apartments on either side; and the building, which is two stories high, is surmounted by an open balcony. The dwellings of the Assyrians were built on too great a scale to permit them to be reproduced as a whole, so M. Garnier has contented himself with a portion of one only. Two types are represented, — one a tent taken from a bas-relief pre-

served in the British Museum, and the other a part of a palace. It was not possible to secure an authentic representation of a Phœnician house, although the suggestions and opinions of the most competent critics have been followed. The result is therefore not much more than a high probability, but as such it possesses great interest. The dwelling has a stone base, with the upper part of wood, ornamented with long slender columns, and with a balcony above.

Like the Assyrians, the Hebrews have two kinds of dwellings, — one a tent, modelled after a carving in an Egyptian tomb dating from before the time of Moses; and the other a stone house, with a flat terraced roof. Here, also, there is want of authentic material, and the result cannot be regarded as more than approximate. The Pelagic hut is a simple one of large stones, while the Etruscan residence consists of a stone basement taken from an ancient terra-cotta model, and an upper portion of wood, with an open-roofed balcony, which is confessedly the personal fancy of the architect. The result, however, may be regarded as near the actual truth as our present knowledge permits.

This completes the first series, and we come to those peoples whose civilization has been affected by the Aryan invasions. First is the Hindoo house, — a tall, narrow affair, built after a bas-relief from the top of Sanchi, though the architect has availed himself of the criticisms of Mr. Fergusson. The Persian house comes next. It is in two parts, — one closed, intended for the women; the other, with a dome of enamelled brick, is the public part, and intended for the master himself and his friends. It is designed after information furnished by M. Dieulafoy. Then comes a German village, — rude wooden cabins, with an elevated structure on poles, which serves as a sort of observatory. Close to this is the Gaul house, — a circular hut of wood, stone, and beaten earth. The former is taken from the bas-reliefs of the column of Trajan, while the latter is taken from a host of authorities that render it probably exact. A Greek house of simple construction comes next. A projection at one side serves to accommodate strangers. The walls have, among other inscriptions, the name of the proprietor, "*Heracles habite ici; que rien de mauvais n'y entre.*" The Roman house, which comes next, is an exact reproduction of a Pompeiian villa. The plan and details of this edifice have been prepared with the greatest care.

A new element in civilization is now introduced by the invasions of the barbarians. The first represented are the Huns, who lived in a wagon, and had no regular dwelling. A Gallic-Roman house of the fifth century follows, and is built of fragments of other buildings, which gives it a very peculiar appearance. The Scandinavian house dates from the fourteenth century, and is of wood, with a granite foundation. It has been designed after the suggestions of the Swedish architect Boberg, who has made a special study of early Scandinavian dwellings. Three other buildings bring us almost to our own times. These are, first, a Romanesque house of the time of the successors of Charlemagne (tenth century); second, one of the middle ages (twelfth century), and contemporary with St. Louis; and the third, a specimen of the civil architecture of the Renaissance, a reproduction of a sixteenth-century house at Orleans.

Four other examples complete the list of the civilizations contributing to the general culture of humanity. These are a Syrian (Byzantine) house of the time of Justinian (sixth century), which is an exact copy of one restored and drawn by the Marquis de Vogüé. It is of stone, as wood was scarce in that part of Syria. A Slavic house, almost a primitive affair, comes next, and is close to the Russian house of the fifteenth century. This latter is in two parts, — one for men, and one for women, — with an external staircase. No material for an authentic dwelling of this period was to be had, but the edifice possesses characteristic features. An Arab house of the eleventh century carries us into an entirely different civilization. The building is not a representation of any standing edifice, but is a combination of authentic elements. Lastly comes a Soudanese dwelling, which, though comparatively modern, is, by reason of its very strangeness, one of the most interesting of the entire collection. This brings us to the third section of the series, those illustrating isolated civilizations. There are houses of China and Japan, huts of the Eskimo and Laplanders, a negro village from Africa, and an Indian hut from North America. The collection is closed by houses from ancient Mexico and Peru.

Barr Ferree.

NOTABLE DERELICTS IN THE NORTH ATLANTIC.

Of the many wrecks afloat in the North Atlantic Ocean, none has as interesting a history as the Italian bark "Vincenzo Perrotta." Abandoned Sept. 18, 1887, this vessel has been represented graphically on every edition of the "Atlantic Pilot Chart" published since that time. Her wonderful drift began in about latitude 36° north, longitude 54° west; and on April 4, 1889, when last reported, she was about 60 miles north of Watling's Island, in the Bahamas. She had thus made good a distance of about 1,400 miles in a general south-west by west direction in one year six months and sixteen days. She has been reported twenty-seven times in all, and when last seen had mizzenmast and about ten feet of mainmast standing, foremast gone, end of jibboom broken off, and port anchor on bow.

On Nov. 26, 1888, the schooner "Ethel M. Davis" was capsized in a hurricane, in latitude 35° 4′ north, longitude 70° 52′ west. Her crew was rescued after having been adrift four days. The schooner eventually righted, and began a long voyage, unguided, in the general direction of the Gulf Stream. She was last seen June 8, 1889, in latitude 42° 36′ north, longitude 57° 38′ west, and at that time had about three feet freeboard in waist, forecastle and poop well above water. Her poop-house is painted white, and shows out well; mainmast gone, bowsprit and ten feet of foremast standing; general drift, about 900 miles north-east by east; time, six months eighteen days; number of times reported, fifteen.

The same hurricane that wrecked the "Ethel M. Davis" also brought disaster to the schooner "David W. Hunt." This vessel was abandoned Nov. 25, 1888, in latitude 34° 30′ north, longitude 72° 30′ west. She was last reported May 26, 1889, in latitude 45° 30′ north, longitude 41° 30′ west, at which time she had her bowsprit and jibboom complete, stumps of two masts broken off about fifteen feet from deck; general drift, east-north-east about 2,000 miles; time, six months; number of times reported, twenty-two.

The schooner "Palatka" bids fair to rival the above vessels in point of interest. She was abandoned April 10, 1889, off Hatteras, and was last reported June 4, 1889, in latitude 43° 20′ north, longitude 56° 34′ west. She was then water-logged and on fire, stern high out of water, no masts standing. Like the "Ethel M. Davis" and "David W. Hunt," she, is right in the highway of the great bulk of transatlantic commerce, and a serious menace to navigation. In one month and twenty-five days she has made good a distance of about 1,200 miles, on a general north-east by east course; number of times reported, twenty-one.

The above four derelicts were all timber-laden, and this accounts largely for their great tenacity and buoyancy, at the same time rendering their destruction no easy matter. Commander C. H. Rockwell, U.S.N., of the United States steamship "Yantic," recently engaged in blowing up wrecks, says, "From the experience thus far gained in the work, I am convinced that lumber-laden derelicts are very tenacious, and can only be overcome by repeated blows from explosives of great power. These continued will undoubtedly do the work."

PROGRESS OF ENGINEERING.[1]

The provision of the By-Laws of this society which requires that its president shall deliver, at the annual convention, an address upon the progress of engineering during the preceding year, has been observed by my predecessors in various ways. While some of the former presidents have confined themselves strictly to the constitutional provision, by general reviews of the professional progress and scientific advancement of the period, others have dwelt more in detail upon some specific subjects of particular interest at the time. I trust I may be permitted, in this instance, to give you first a cursory glance of the field at large, and then confine myself more particularly to a review of the progress in that

[1] Address of Max J. Becker, president of the American Society of Civil Engineers, delivered at the annual convention of the society at Seabright, N.J., June 20.