tion from what part of the country he comes. For the study of pronunciation the received spelling is very ill adapted, and a phonetic system is needed if this part of the work is to be conducted in an intelligible manner. In the cases mentioned under I., where the pronunciation is of only secondary importance, such a system is not needed. It is necessary only where the pronunciation is the main thing to be noted, though it will be welcome whenever the pronunciation might be doubtful. A practical, though necessarily imperfect, system of phonetic spelling will be sent to any person who communicates with the secretary.

The officers of the society are, president, Francis J. Child, Cambridge, Mass.; vice-president, James M. Hart, Cincinnati, O.; secretary, Edward S. Sheldon, 27 Hurlbut Street, Cambridge, Mass.; treasurer, Charles H. Grandgent, Cambridge, Mass.; editing committee, the secretary *ex officio*, George L. Kittredge (Cambridge, Mass.), Sylvester Primer (Charleston, S.C.); executive committee, the officers named above, and Benjamin I. Wheeler (Ithaca, N.Y.), Charles F. Smith (Nashville, Tenn.), Frederic D. Allen (Cambridge, Mass.).

THE BOWER-BARFF RUSTLESS IRON PROCESSES.

THESE processes have for their object the protection of iron and steel from rusting. This result is obtained by the conversion of the surface of the metal into magnetic oxide of iron. The oxide is well known in its natural state as magnetic iron ore, which has withstood without deterioration or change centuries of exposure to the atmosphere and to fresh and salt water.

The Barff process consists essentially in subjecting to the action of superheated steam the articles which are to be rendered rust-proof. The treatment is carried out in a specially constructed furnace, and is more particularly applicable to wrought iron and highly finished and polished work.

The Bower process accomplishes the formation of magnetic oxide upon iron articles by subjecting them successively to the actions of highly heated air and carbonic-oxide gas derived from coal fires. The hot air converts the metallic surface into red oxide of iron, which is reduced to the black or magnetic oxide by the gas.

No foreign material, such as paint, alloy, or chemical of any kind, is applied to the metal; so that the coating is perfectly innocuous, and, owing to the simplicity of the process, its cost is less than that of galvanizing.

Surfaces of iron and steel treated by the Bower-Barff processes present a pleasing blue-gray or blue-black color, and preserve the sharp outline of artistic designs, while, if the articles are polished before treatment, the result of the oxidation is a lustrous, ebony-black finish.

The Bower-Barff processes have now a record of over four years in the United States, so that it is no longer necessary to refer to European practice for evidences of their value. In furnace construction, and other particulars, marked improvements have been made. Furnaces have already been established in the States of Pennsylvania, New Jersey, New York, Connecticut, Massachusetts, and Illinois, and others will shortly be erected.

The oxide process is applicable to all forms of cast, malleable, and wrought iron and steel, where the surfaces are not subjected to very severe friction, nor injured by subsequent manipulation. It is gradually supplanting the expensive and usually unsatisfactory galvanizing, and for ordinary culinary utensils is taking the place of tinning and enamelling. Where, for the sake of appearance, enamel is preferred, English manufacturers have adopted the process, because it is found that by first oxidizing the articles the enamel is rendered far more durable.

The demand by users of cast and wrought iron pipe for plumbing, drainage, gas, salt-works, steam-heating, and wherever it is desirable to protect pipes from rusting, is one of the most significant indications of the recognition of the value of the process.

The following brief review of the processes, in their leading features and recent developments, may serve to show how readily they can be adapted through a very extended range of iron manufactures.

The conversion of the surface of metallic iron into magnetic oxide of iron is carried out in a furnace. The articles to be treated, whether large or small, are loaded upon an iron drag, and shoved into a fire-brick chamber, known as the oxidizing-chamber of the furnace. Gas-producers, which constitute a part of the furnace structure, generate carbonic-oxide gas from a thick bed of coal upon the producer-grates. This gas is burned by an admixture of air in a combustion-flue beneath the oxidizing-chamber; and either the burning gases, or the hot products of combustion, according as the gas and air valves are regulated, enter through ports into the chamber, heating the charge, and then passing through exit ports to the chimney. After the goods have been raised by this means to the desired temperature, which may vary from an incipient red to a cherry heat, depending on the nature of the work, the treatment of the charge is begun. If the goods consist of castings, the Bower process of alternating oxidizing and reducing operations is generally employed. During the period of oxidation, the connection with the gas-producers is almost entirely cut off by a damper; and air, raised to a high temperature by passing through the hot combustion-flue above mentioned, enters the chamber and oxidizes the iron, converting its surface into the red oxide of iron (Fe_2O_3). After about forty minutes of this treatment, the admission of air to the furnace is stopped, and the producer-gases are allowed to pass for twenty minutes through the chamber without any admixture whatever. The chemical action of these gases upon the ironware results in a change or reduction of the superficial coating of red oxide of iron into the black or magnetic oxide ($Fe\ O_4$). The operations are repeated a number of times, so that the whole treatment lasts from ten to twenty hours, according to the thickness of the coating to be produced. At the end of the treatment the charge is withdrawn, and the furnace is then ready for treating another lot of ware.

The Barff process for wrought iron is carried out in the same furnace designed for the Bower treatment. The articles are charged and heated in the same manner as above; and, when the proper temperature is reached, highly superheated steam is introduced into the oxidizing-chamber, where a slight plenum, not exceeding one to two inches of water-pressure, is maintained for a period of ten to twenty hours. The steam from a half-inch pipe more than suffices for all the requirements. The superheating is easily effected by a continuous coil-pipe superheater, or by a couple of small intermittent superheating chambers, each filled with a loose checker-work of fire-brick, and forming part of the furnace structure.

The Bower or air process is the more economical one for the treatment of ordinary cast iron; whereas, for wrought and malleable iron, the Barff or steam process has been found more advantageous. Where wrought and cast iron work are combined, the Barff process is applicable. The steam treatment of the cast iron in such a case merely necessitates a longer period of exposure in the furnace than would suffice for producing the desired coating by the air process.

The mechanical finish of the iron, be this either wrought or cast, determines to a large extent the mode of treatment. Rough articles, from which the skin has not been removed, require for the formation of a proper coating in a given time higher heat and more energetic oxidation than goods whose surfaces are more or less finished. A high heat on a finished surface tends to blister and detach the magnetic oxide as it is formed. When articles, therefore, present some finished surfaces, and others which are rough, a comparatively low heat is used in the oxidizing-chamber, thereby precluding the possibility of injuring the surface; while the treatment is continued for a sufficient length of time to insure a thorough oxidation of the rough parts, even at the reduced temperature.

For the steam treatment of highly polished articles, a small muffle furnace is employed. The charge is heated by a flame which plays externally around the muffle. The increased expenditure of fuel thus incurred in heating the articles is more than compensated, in a furnace of small size, by the ease with which even a slight overheating of any portion of the polished goods is prevented.

The magnetic oxide coating is very hard, but comparatively inelastic. It withstands the wear due to friction, but is injured by blows of the hammer and rough usage. Wherever from this cause

the coating is chipped, the iron rusts, though the rust remains localized: it very rarely spreads or raises the coating, as is the common case with paint or electro-deposits.

The protection of the iron being due to a superficial layer of magnetic oxide, and not to any thing penetrating the metal (which would weaken it), it follows that any manipulation that would injure or destroy the continuity of the surface of the iron must necessarily prove destructive of the coating. In riveting, for example, the coating in the immediate neighborhood of the rivet-holes suffers; similarly, in driving nails through sheet-iron roofing, the oxide is chipped at the holes; in fitting "rustless" gas and steam pipe, it is injured by the bite of the wrench and vise, unless these are furnished with lead or copper cheeks; in shearing, it scales along the edge of the metal; and in flanging or bending sheet-iron, the coating on the line of the bend is cracked. The limit of elasticity of the oxide is practically the same as that of the iron: it adheres firmly to the metal under tensile and compressive strains until this limit has been reached, and no further.

A piece of "rustless" iron can be heated on a kitchen range and then plunged into cold water without the least scaling or other change; while coverings of paint, tin, galvanizing, and enamel suffer very much under such action. For this reason, "rustless" hollow ware is more readily cleaned than even enamel ware. The latter must be allowed to cool after use; and the remains of food in it become dried and congealed, and stick to the utensil, necessitating considerable scraping, and involving danger of injuring the enamel.

Magnetic oxide withstands the action of many brines, alkalies, sulphuretted gases, and weak, organic acids, but it is gradually dissolved by sulphuric and hydrochloric and other powerful acids. The corroding action of these acids, however, is considerably retarded on "rustless" iron, and hence such iron has been successfully used in chemical works where it was exposed to strong acid fumes. Coated articles have been exposed for years, without the slightest deterioration, to sea-water and to the most varied atmospheric conditions.

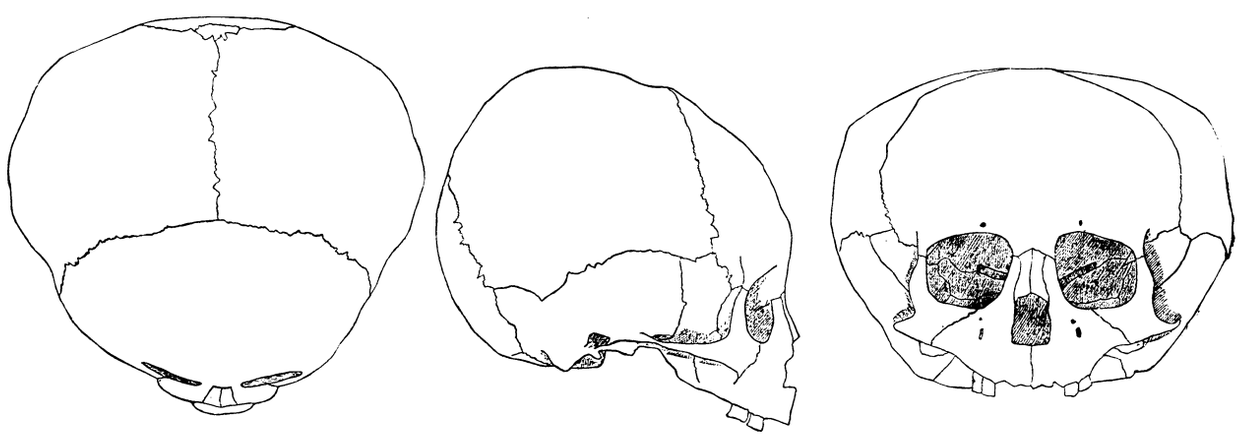

FIG. 1.—ORTHOGONAL VIEWS OF INFANTILE SKULL FROM COWICHAN, B.C.

ETHNOLOGY.

Notes from British Columbia.

IN 1879 Mr. Wardman, an intelligent reporter, accompanied the United States revenue cruiser "Rush" on her trip to Alaska, and described his experiences in a number of interesting letters to the Pittsburgh *Dispatch*. Some of his observations are well worth being rescued from the obscurity of a local paper.

He gives an interesting description of the Haida medicine-man: "The Indian doctor of the coast is an awfully mysterious personage. His first steps in the art of healing, according to the traditions of his tribe, are taken at an extremely early day in his career. Should a child be born with curly hair, a strabismical eye, or distorted limbs, he is accepted as a healer of coming generations, and all his early training is carefully conducted with a view to increasing his supernatural powers, and control over the spirits of the air. His food is carefully selected, and many articles of every-day use among the common herd are carefully excluded from his bill of fare. He is put in training for a doctor from his infancy, and great things are expected of him when fully developed and endowed with his degree.

"The doctor seldom washes his person, and never cuts his hair, which grows long and bushy in masses, knotted from want of combing, and entangled with burrs and general rubbish, such as floats around an Indian encampment. He adorns his scanty raiment with eagle's down, and altogether presents a weird, not to say untidy appearance.

"In cases of serious illness among members of the tribe, the eastern medicine-man will administer sparingly some pulverized herbs and teas in considerable draughts; but the Haida doctor of the Queen Charlotte Islands scorns all sublunary aids, powders or lotions. When an Indian is very sick, the doctor proceeds slowly at first to agitate his attendant spirit, which is called 'Yēk' (in the Tlingit language), and, by extraordinary contortions and severe gymnastic exercises, succeeds, in the course of half an hour, in working himself up into a perfect paroxysm of clairvoyancy, throwing off his garments as he progresses, till finally he stands arrayed in a Lydia Thompson skirt about his loins, but is otherwise clothed in foam and perspiration. Then he is ready for business.

"He then makes 'passes' toward the body of the patient, inhaling powerfully through his teeth. Having sucked the disease out of the form of the sick man, the doctor proceeds to the centre of the house, and blows it out up the opening where smoke from the fire finds its exit. Of course, the patient is now in a fair way to recovery. But, in case the patient does not evince any signs of improvement, the doctor finds that the 'conditions are not favorable' owing to the influence of some witch who has evoked an evil spirit to operate against the recovery. In such a case it becomes the doctor's first duty to point out the witch, who is stripped, bound, and subjected to a perfectly puritanical course of torture, with a view of forcing a confession. The rack, the scourge, and starvation finally have the desired effect, and the witch acknowledges any thing that the doctor demands. This is always gratifying, and is considered one of the greatest triumphs of the healing art; but, should the confession be made too late to effect the desired cure, the witch may be killed, and generally is sacrificed on general principles. Even though the patient dies under these circumstances, it is still a triumph for the doctor, as killing the witch is as good a proof of witchcraft in Alaska to-day as it was in New England two hundred years ago.

"The Haida, as well as other Indians of the north-west coast,