world in its use of the steam horse, and yet how much poetry there is in that little post office all alone by itself on the Booby Island, that we have described—the sublimest poetry, that of love for mankind!

The poet of the modern postal system has not yet appeared; but he will find plenty of material. He will be able to depict the dangers a postman passes through in discharging his duty on the field, he will sing the praises of those who are injured in a railroad disaster, and yet continue their good work.

He can also praise the noble thought of uniting the nations, which assumed its first tangible form in the world's mail. It will not be a sentimental song, but one full of power and indicative of our own time, in

FIG. 23.—POST OFFICE ON BOOBY ISLAND.

FIG. 25.—SWISS ALPINE POST IN WINTER.

dition after a little use. This involved a difficulty in cleaning them when necessary. The English plates were not open to this objection; in fact, when the outer surfaces were planed away, they remained perfectly smooth and compact.

Large plates have been known to disintegrate and fall to pieces after being used for some time. A large anode surface, compared with that of the article to be plated, is of paramount importance. The tank should be sufficiently wide to take the largest article for plating, and to admit of the anodes being moved nearer to or further from the article. In this way the necessary electrical resistance can very conveniently be inserted between the anode and cathode surfaces. The elimi-

FIG. 24.—BOSNIAN POST.

FIG. 26.—SOLDIER POSTMAN OF THE EIGHTEENTH CENTURY.

spite of those who scorn it.—*Translated for the Scientific American Supplement by Jenny H. Beach, from Neue Illustrirte Zeitung.*

ON NICKEL PLATING.

By THOMAS T. P. BRUCE WARREN.

THE compound used principally for the electro-deposition of nickel is a double sulphate of nickel and ammonia. The silvery appearance of the deposit depends mainly on the purity of the salt as well as the anodes. The condition of the bath, as to age, temperature, and degree of saturation, position of anodes, strength of current, and other details of manipulation, which require care, cleanliness, and experience, such as may be met with in any intelligent workman fairly acquainted with his business, are easily acquired.

In the present paper I shall deal principally with the chemical department of this subject, and shall briefly introduce, where necessary, allusion to the mechanical and electrical details connected with the process. At a future time I shall be glad to enlarge upon this part of the subject, with a view of making the article complete.

A short time ago nickel plating was nearly as expensive as silver plating. This is explained by the fact that only a few people, at least in this country, were expert in the mechanical portions of the process, and only a very few chemists gave attention to the matter. To this must be added that our text-books were fearfully deficient in information bearing on this subject.

The salt used, and also the anodes, were originally introduced into this country from America, and latterly from Germany. I am not aware of any English manufacturer who makes a specialty in the way of anodes. This is a matter on which we can hardly congratulate ourselves, as a well known London firm some time ago supplied me with my first experimental anodes, which were in every way very superior to the German or American productions. Although the price paid per pound was greater, the plates themselves were cheaper on account of their lesser thickness.

The texture of the inner portions of these foreign anodes would lead one to infer that the metallurgy of nickel was very primitive. A good homogeneous plate can be produced, still the spongy, rotten plates of foreign manufacture were allowed the free run of our markets. The German plates are, in my opinion, more compact than the American. A serious fault with plates of earlier manufacture was their crumpled con-

dition after a little use. This involved a difficulty in cleaning them when necessary. The English plates were not open to this objection; in fact, when the outer surfaces were planed away, they remained perfectly smooth and compact.

At one time a mechanical arrangement was made, by which the cathodes were kept in motion. The addition of a little borax to the bath is a great advantage in mitigating the appearance of gas. Its behavior is electrical rather than chemical. If the anode surface is too great, a few plates should be transferred to the cathode bars.

When an article has been nickel plated, it generally presents a dull appearance, resembling frosted silver. To get over this I tried, some time ago, the use of bisulphide of carbon in the same way as used for obtaining a bright silver deposit. Curiously the deposit was very dark, almost black, which could not be buffed or polished bright. But by using a very small quantity of the bisulphide mixture, the plated surfaces were so bright that the use of polishing mops or buffs could be almost dispensed with. When we consider the amount of labor required in polishing a nickel plated article, and the impossibility of finishing off bright an undercoat surface, this becomes an important addendum to the nickel plater's list of odds and ends.

This mixture is made precisely in the same way as for bright silvering, but a great deal less is to be added to the bath, about one pint per 100 gallons. It should be well stirred in, after the day's work is done, when the bath will be in proper condition for working next day. The mixture is made by shaking together, in a glass bottle, one ounce bisulphide and one gallon of the plating liquid, allow to stand until excess of bisulphide has settled, and decant the clear liquid for use as required. It is better to add this by degrees than to run the risk of overdoing. If too much is added, the bath is not of necessity spoiled, but it takes a great deal of working to bring it in order again.

About eight ounces of the double sulphate to each gallon of distilled or rain water is a good proportion to use when making up a bath. There is a slight excess with this. It is a mistake to add the salt afterward, when the bath is in good condition. The chloride and cyanide are said to give good results. I can only say that the use of either of these salts has not led to promising results in my hands.

In preparing the double sulphate, English grain nickel is decidedly the best form of metal to use. In practice, old anodes are generally used.

The metal is dissolved in a mixture of nitric and

dilute sulphuric acid, with the application of a gentle heat. When sufficient metal has been dissolved, and the unused nitric acid expelled, the salt may be precipitated by a strong solution sulphate of ammonia, or, if much free acid is present, carbonate of ammonia is better to use.

Tin, lead, and portion of the iron, if present, are removed by this method. The silica, carbon, and portions of copper are left behind with the undissolved fragments of metals.

The precipitated salt, after slight washing, is dissolved in water and strong solution ammonia added. A clean iron plate is immersed in the solution to remove any trace of copper. This plate must be cleaned occasionally so as to remove any reduced copper, which will impede its action. As soon as the liquid is free from copper, it is left alkaline and well stirred so as to facilitate peroxidation and removal of iron, which forms a film on the bath. When this ceases, the liquid is rendered neutral by addition of sulphuric acid, and filtered or decanted. The solution, when properly diluted, has sp. gr. about 1.06 at 60° F. It is best to work the bath with a weak current for a short time until the liquid yields a fine white deposit. Too strong a current must be avoided.

If the copper has not been removed, it will deposit on the anodes when the bath is at rest. It should then be removed by scouring.

Copper produces a reddish tinge, which is by no means unpleasant compared with the dazzling whiteness of the nickel deposit. If this is desired, it is far better to use a separate bath, using anodes of suitable composition.

The want of adhesion between the deposited coating and the article need not be feared if cleanliness be attended to and the article, while in the bath, be not touched by the hands.

The bath should be neutral, or nearly so, slightly acid rather than alkaline. It is obvious that, as such a liquid has no detergent action on a soiled surface, scrupulous care must be taken in scouring and rinsing. Boiling alkaline solutions and a free use of powdered pumice and the scrubbing brush must on no account be neglected.

A few words on the construction of the tanks. A stout wood box, which need not be watertight, is lined with sheet lead, the joints being blown, not soldered. An inner casing of wood which projects a few inches above the lead lining is necessary in order to avoid any chance of "short circuiting" or damage to the lead from the accidental falling of anodes or any article which might cut the lead. It is by no means a necessity that the lining should be such as to prevent the liquid getting to the lead.

On a future occasion I hope to supplement this paper with the analysis of the double sulphates used, and an account of the behavior of electrolytically prepared crucibles and dishes as compared with those now in the market.—*Chem. News.*

CHILLED CAST IRON.

AT a recent meeting of the engineering section of the Bristol Naturalists' Society a paper on "Chilled Iron" was read by Mr. Morgans, of which we give an abstract. Among the descriptions of chilled castings in common use the author instanced the following: Sheet, corn milling, and sugar rolls; tilt hammer anvils and bits, plowshares, "brasses" and bushes, cart-wheel boxes, serrated cones and cups for grinding mills, railway and tramway wheels and crossings, artillery shot and bolts, stone-breaker jaws, circular cutters, etc. Mr. Morgans then spoke of the high reputation of sheet mill rolls and wheel axle boxes made in Bristol. Of the latter in combination with wrought iron wheels and steeled axles, the local wagon works company are exporting large numbers. With respect to the strength and fatigue resistance of chilled castings, details were given of some impact tests made in July, 1864, at Pontypool, in the presence of Captain Palliser, upon some of his chilled bolts, 1 3/4 in. long by 4 in. diameter, made from Pontypool cold-blast pig iron. Those made from No. 1 pig iron—the most graphitic and costly—broke more easily than those from No. 2, and so on, until those made from No. 4 were tested, when the maximum strength was reached. No. 4 pig iron was in fracture a pale gray, bordering on mottled. Several points regarding foundry operations in the production of chilled castings were raised for discussion. They embraced the depth of chill to be imparted to chilled rolls and railway wheels, and in the case of traction wheels, the width of chill in the tread; preparation of the chills—by coating with various carbonaceous matters, lime, beer grounds, or, occasionally, some mysterious compost—and moulds, selection and mixture of pig irons, methods and plant for melting, suitable heat for pouring, prevention of honeycombing, ferrostatic pressure of head, etc. Melting for rolls being mostly conducted in reverberatories, the variations in the condition of the furnace atmosphere, altering from reducing to oxidizing, and *vice versa*, in cases of bad stoking and different fuels, were referred to as occasionally affecting results. Siemens' method of melting by radiant heat was mentioned for discussion. For promoting the success of a chilled roll in its work, lathing or turning it to perfect circularity in the necks first, and then turning the body while the necks bear in steady brasses, are matters of the utmost importance.

The author next referred to the great excellence for chilling purposes possessed by some American pig irons, and to the fact that iron of a given carbon content derived from some ores and fluxes differed much in chilling properties from iron holding a similar proportion of carbon—free and combined—derived from other ores and materials. Those irons are best which develop the hardest possible chill most uniformly to the desired depth without producing a too abrupt line of division between the hard white skin and the softer gray body. A medium shading off both ways is wanted here, as in all things. The impossibility of securing a uniform quality and chemical composition in any number grade of any brand of pig iron over a lengthened period was adverted to. Consequent from this a too resolute faith in any particular make of pig iron is likely to be at times ill-requited. Occasional physical tests, accompanied with chemical analysis of irons used for chilling, were advocated; and the author was of opinion it would be well whenever a chilled casting had enjoyed a good reputation for standing up to its work, that when it was retired from work some portions