

naval guns, being 52 feet long, while the hold is 80 feet in length. The vessel is 165 feet in length between perpendiculars, its beam is 26 feet, and its molded depth, 13 feet 8 inches. The engines and boilers are placed aft and are protected by wing bunkers. The ship is provided with a long, raised quarter-deck 70 feet in length, and a forecastle deck 26 feet in length. The engines are of the triple-expansion type, with cylinders 13½ inches, 20½ inches, and 31 inches in diameter by 24-inch stroke, indicating 500 horse power. Steam is supplied by one large single-ended boiler, constructed for 155 pounds working pressure.

#### THE HALL-MARKING OF GOLD AND SILVER IN ENGLAND.

There are probably few countries where the gold and silver manufacturers and the public are so protected, and all possibility of fraud rendered abortive, as in Great Britain. In England, no plate manufacturer is permitted to sell, and no member would even attempt to purchase a piece of silver or gold plate, that had not received the "hall-mark." This symbol is stamped upon every section of plate, and is an absolute guarantee of the purity of the metal. "Hall-marking" is protected by the legislature. Fraudulent hall-marking is so heavily-punishable an offense, that attempts to deceive the public by means of spurious hall-marks are practically unknown. Probably few articles can be so easily adulterated as silver and gold, and were there no such protection as hall-marking in vogue, the public would be extensively defrauded, as the purity of the metals cannot be determined by cursory examination, but only by elaborate testing.

Hall-marking gold and silver plate in England is an exceedingly ancient custom. In the whole of the United Kingdom there are only seven government assay offices—four in England, two in Scotland, and one in Ireland. Although the principal office is the Royal Mint, London, the most important and busiest assay office is that at Birmingham, the center of the jewelry industry of England, where enormous quantities of articles are stamped every day. The first statute passed authorizing the stamping of gold and silver with its carat purity, was enacted over five hundred years ago, and the main principles then laid down, are still in vogue to-day. The wording of the original law was as follows: "Because gold and silver, which is wrought by goldsmiths in England, is oftentimes less fine than it ought to be; because the goldsmiths are their own judges, be it ordained that henceforth every goldsmith put his mark upon his work, and the assay of the Touch belongs to the mayor and governors of the cities and boroughs, with the aid of the Master of the Mint, if there be such, putting the mark of the city or borough where the assay is." During the course of years, owing to the mayors of cities having become more deeply engrossed in more urgent municipal affairs, the task of testing plate originally assigned to them, has devolved upon the Goldsmiths' Company.

The standard of purity is governed by the legislature. Pure metal is estimated at 24 carats. But pure gold articles, owing to the softness of the pure metal, would be of practically no use for commercial purposes, so a certain percentage of alloy is permitted, the carat value being reduced correspondingly. Formerly there was only one standard in existence, and all articles which were not equal to this standard were destroyed. But in view of the demand for plate articles containing various proportions of metal, five standards of gold and two of silver have been authorized by the government. The five old standards for gold are 22, 18, 15, 12, and 9 carats respectively, in an alloy of 24 carats. Every article submitted to the Assay Office must correspond with one of these standards; otherwise it is not stamped, but is broken to fragments and rendered unsalable.

The Birmingham Assay Office employs 190 hands, a large majority of whom are women. The amount of jewelry stamped is considerable, and the work is carried out with remarkable thoroughness. For instance, in the case of gold and silver chains, every link is assayed and stamped, yet the fee is only 10 cents in the case of a gold chain, and 3 cents for a silver chain. Owing to the heavy business transacted at this office, the fees levied for hall-marking are only approximately one-third of those authorized by the legislature. No hollow plate ware less than .0076 inch thick is stamped, this being the minimum thickness stipulated by the office. Thin wares need not be stamped, nevertheless the retailer, if required by his customer, must get his goods stamped.

The plate is brought to the institution in a practically completed state. The manufacturer stamps each article with his own initials, and indicates upon a statement what the gold or silver carat value of the articles deposited is supposed to be. The goods are deposited at the office in the early morning and are fetched in the evening.

The plate is then taken in hand by the assayers. The maker's initials are first compared with those registered at the offices, the articles are examined to see if they are quite complete, and also to ascertain if the

amount of solder required to effect the necessary joints is not excessive. If these investigations prove satisfactory, a small portion of the metal is cut or scraped away, and this, which is called the "diet," is sealed up and reserved for the Master of the Mint, who periodically tests the metal and checks the work of the assayers. The article is then passed on to the testing room, where exactly five grains of it are weighed out with delicate scales, and wrapped in a thin sheet of lead ready for the assay.

There are two consecutive methods of testing gold, and two alternative processes for assaying silver. Formerly the metals were tested by simply rubbing the plate with a piece of hard, black, smooth stone, and then wetting the "touched" pieces with the tongue, which operation divulged the various tints that distinguish one rare metal from another. But this process is far too primitive nowadays, when metals can be so easily and closely adulterated, while too much also depends upon the judgment of the operator, for any reliable estimation of the purity of the metal to be gained, though it is still employed for certain purposes.

The testing process for gold, recognized by law, is that known as the "dry" process, but there is also another method known as the "wet," which is more efficacious and quicker than the former, and is indeed rapidly superseding it. The dry process is utilized in the testing of both gold and silver. The five grains of metal obtained from the article is rolled up in the small sheet of lead, and placed in a small cupel containing calcined bone. The vessel is then heated over a gas fire in an air furnace, the result of which operation is that the base metals alloyed with the gold or silver oxidize, and are absorbed by the calcined bone. The small pill of gold left in the cupel is then weighed, and by deducting its present weight from the five grains which it weighed before cupellation, the proportion of gold or silver in the plate can be ascertained. For testing silver by this dry method, nothing more is necessary, but as silver is alloyed with gold, a further operation is necessary to extract the silver from the rarer metal. The second operation is technically called "the parting," and consists of boiling the small pill of gold, which by the way has been treated with a quantity of silver to facilitate the dissolving of silver alloyed with the gold, in a platinum vessel containing nitric acid. This solution rapidly dissolves the silver, but exercises no effect upon the gold. When all the silver has been extracted from the gold, the latter metal is so brittle that it cannot be handled, and therefore has to pass through an annealing process, after which it is weighed, and, by comparing its present weight with the original five grains, a correct estimate of the quantity of gold in the assayed article is obtained.

In the "wet" testing process, so far only utilized for silver, the latter metal is plunged in nitric acid and dissolved, and solutions of iron and salt are added by means of graduated pipettes. Common salt may be employed, but better results are gained with sulpho cyanide. This test is based upon the principle that a certain quantity of salt solution will precipitate a certain quantity of silver before acting on the iron. Therefore, if the liquid in the glass vessel is not discolored by the iron, the vessel contains at least the standard quantity of silver. Then it is necessary only to compare the sample with one prepared for standard silver, and the assayer can immediately ascertain whether the sample is equal or below the standard.

After passing through the tests, the articles are stamped, or "hall-marked," as it is called. This process is simultaneous with the assaying. For gold articles, the standard marks are a crown and the carat number for the two highest carat standards—22 and 18 carats respectively—this number being followed by decimals representing the proportion of gold in the alloy for the 15, 12, and 9-carat quantities. The number is followed by the symbol or mark of the assaying office, which in the case of Birmingham is an anchor, while the year in which the assay was made is represented by a letter. At last come the manufacturers' initials. Although the hall-marks are stamped boldly upon the article, some makers are agitating for them to be imprinted with still bolder marks, and also for the addition of further marks, as customers are always guided in the choice of wares by the hall-mark, knowing full well that the article is as represented, and that no fraud is being practised. By the foregoing series of marks it is possible to ascertain by reference to the hall-mark, the manufacturer, the year of assay, quality of gold, and the office in which the article was assayed. Last year 407,698 ounces of gold, and 3,272,950 ounces of silver were hall-marked at Birmingham.

Every article submitted to the Assay Office is returned marked. If it does not correspond to the manufacturer's statement of the carat value, it is smashed to pieces, and returned to the manufacturer, in fragments to be remade. Under no circumstances whatever is gold or silver plate delivered from the Assay Office without the hall-mark. If a private person wishes to ascertain the carat value of a piece of gold or silver plate, procured abroad, and submits it to the Assay

Office to be tested, it is duly assayed, and the owner informed of its carat value, but if it does not correspond to one of the standards, no matter what its value may be, it is smashed and returned to the owner in pieces. Last year 2995 ounces of gold plate, and 3804 ounces of silver plate were destroyed for being under the manufacturers' statement values.

Extreme precautions are observed to prevent fraudulent hall-marking, or the stamping of articles with a higher carat mark than they actually are; and to prevent ruthless breaking owing to deficiency in carat value. One assay master and two warders are compelled by law to be present when any plate is being marked or broken. To prevent tampering with the hall-marking dies, they are always kept in a strong box, whenever they are not in use, fitted with three different locks, the key of each lock being retained by one of the trio. These precautions are absolutely necessary because the manufacturer is entirely at the mercy of the assayers. The manufacturer suffers no loss from the abstraction of the "diet" for the master of the mint, but the amount is voluntarily surrendered by the office.

#### SCIENCE NOTES.

Through the liberality of George W. Perkins, of New York, an expedition was sent by the New York Botanical Garden to Nova Scotia and Newfoundland. The expedition has secured 12,000 specimens of over 2,000 species of plants. A third of the specimens are marine plants.

The recent expedition sent to north Montana by the New York Botanical Garden has done much in the interest of scientific botany. Many Alpine forms of plants were discovered. Ample statistics were secured establishing the variation of plant life caused by temperature and latitude, and of the general vertical distribution of flora.

Recently at an auction sale in London which was judiciously advertised, an egg of the great auk was put up which after some lively bidding was knocked down for \$1,260. That is said to be a very good price. But auk eggs have been sold in London for as much as \$1,500. The reason for these enormous prices is naturally to be found in the scarcity of the eggs. The bird is extinct, and not over seventy of its eggs are in existence.

Charles Rothschild has, perhaps, the most curious museum of any collector in Europe. At Tring Park he keeps thousands and thousands of fleas. The museum is in charge of Dr. Jordan. Every animal and bird has its particular kind of flea. Very many have several different kinds. It clearly follows that the gathering of fleas affords diverse material for the collector. In the Rothschild collection is one mole flea (*Hystrichopsylla talpæ*) a fifth of an inch in length.

Charles Gilmore, of Laramie, and E. B. Cavell, who have been at work all summer in the fossil fields at Medicine Bow for the Carnegie Institute at Pittsburg, have dropped their work for the winter. The summer netted them about a carload of fossils, which will be shipped to Pittsburg. The finds were numerous and valuable, though no astonishing results followed their labors. Walter Grainger, who is at work in the Medicine Bow field for the American Museum of Natural History of New York, also has a carload of fossils to go forward, but he will remain in the field for time being. He reports a large number of curious and valuable finds, and expects to return to this field next summer.

Hungarian dentists and chemists claim to have discovered a valuable local anæsthetic, an alkaloid, nervocidine, the hydrochloride of which is stated to have similar properties to cocaine, but to produce a much more lasting anæsthesia. The base is obtained from an Indian plant, "Gasu Basu," the properties of the leaves of which were first discovered by D. Dalma, who successfully employed them in painful pulpitis with such good results that he reported that the drug might displace arsenic for dental purposes. B. von Fenyyessy has investigated the properties of the alkaloidal hydrochloride, as prepared by Dalma, which is a yellow, amorphous, hygroscopic powder, readily soluble in water. It produces marked anæsthesia of the cornea in 0.1 or 0.2 per cent solution, which is very persistent, and a 0.1 per cent solution brushed on the mucous membrane of the cheek also gives marked anæsthesia. Stronger solutions, exceeding 0.5 per cent, produce irritation of the cornea, and a 2 per cent solution causes ulcerative keratitis in dogs and rabbits, which lasts ten days, during which period the anæsthesia also lasts. It does not appear to produce anæsthesia by subcutaneous injection. Its general effect is that of a paralyzing poison. Although its anæsthetic effect is much more prolonged than that of cocaine, the length of time necessary before this effect supervenes, the irritation caused by the drug, and the toxic symptoms it produces, do not point to the probability of its being of general service, except perhaps in dental practice.—Lancet.