XXVIII.—*On the Manipulation of Assays of Gold and Silver Bullion.*

By CHARLES TOOKEY, Assayer in the Japanese Imperial Mint, formerly in the Royal Mint, Hong Kong.

IN the year 1854, in conjunction with the late Mr. T. H. Henry, I began to work out an investigation relative to certain methods by which ordinary assays of gold bullion might be made with greater rapidity than was then practicable.

The number of separate processes, from the first weighing in of a piece of gold bullion to the second weighing out before its value can be ascertained, are well known to all assayers. The object which we had in view was to treat a batch of assays simultaneously, instead of handling them in rotation and individually, as by the ordinary method.

The first step was to substitute a perforated tube holding the assay for the parting flask, which should allow of free access of the nitric acid used for separating the gold and silver. The original tube was made by inserting a circular piece of perforated platinum foil near one end of the neck of a pear-shaped parting flask.

By providing these tubes with a shoulder near the upper end, they could be easily supported by a porcelain tile having circular holes, the tubes and holes being numbered, so that each assay occupied the same relative position throughout the operations; the whole arrangement could then be lowered, till the assays were sufficiently immersed, into one vessel of nitric acid of proper strength, boiled for the requisite time, taken out, boiled a second time in stronger acid, washed, dried, and annealed, thus managing the whole as one assay, and thereby saving a considerable amount of time.

I need not enter here into the various points for consideration in the application of this system; I have simply wished to show how it originated, and to mention that the apparatus is now made wholly of platinum.

One of the operations in the assay of silver bullion by the "dry method" consists in carefully hammering the buttons after they have been detached from the cupels, and then brushing them, in order to remove adhering portions of bone-ash, which has been saturated with oxide of lead during the process of cupellation.

This operation, like the individual system in gold assaying, occupies much time, and is certainly open to objection, especially when the bullion is not of high standard, because the hammering squeezes up the porous under-surface of the buttons, and causes them to retain mechanically portions of bone-ash, which no amount of brushing will wholly remove.

It may be admitted here that as all the assay buttons, including the "checks" which are used to control the results, are treated in a similar manner, the amount of error is reduced to a minimum. At the same time a mechanical operation, which can seldom be exactly the same in any two cases, must yield to a more certain process, which in its action is uniform throughout.

In the Royal Mint at Hong Kong, I substituted another method for cleansing the assay buttons; when systematised it occupies much less time, and is more satisfactory and certain in its action than the old process.

The silver buttons, after being detached from the cupels by means of forceps, are transferred to a platinum plate, having depressed perforated cavities arranged and numbered to correspond with the cupels in the muffle. The buttons are placed in their respective places with the underside uppermost, and by means of a handle of platinum wire attached to the plate, the whole is immersed in pure hydrochloric acid (in the proportion of one part of strong acid to two of water), the acid is heated sufficiently (not boiled), and when all the bone-ash, &c., has been dissolved, the plate is lifted out by its handle, washed first in hot water acidulated with hydrochloric acid, and, lastly, in pure water; the plate is then drained by being placed upon porous paper, and dried perfectly over a gas or

spirit lamp. Two assay buttons, one of which has been subjected to the ordinary treatment by the hammer and brush, and the other to the process which I have described, will have distinct appearances under a magnifying glass, and from the former, phosphate of lime may, in most cases, be separated and identified.