permit a large quantity of steam to escape to the storage reservoir, an outlet pipe from the latter carrying off the saved exhaust steam to utilize for other purposes. If desired, also, these valves, instead of opening into the exhaust ports, may be arranged in the heads of the cylinder.

This improvement has been patented by Mr. Andrew J. Clark, of Dayton, Tenn.

THE ASSAYING OF GOLD AND SILVER ORES.

The process of assaying silver ores is based upon the following considerations: Any compound of silver exposed to high heat in the presence of metallic lead or of oxide of lead and of a reducing agent gives up its silver in a metallic state, and in practice an alloy of lead and silver containing all the precious metal of the sample of ore used is obtained.

The ore before being assayed is carefully sampled, so as to represent an exact average, as nearly as possible, of the mine, vein, or heap from which it is taken. It is next pounded in an iron mortar and the process continued until it is very finely pulverized. A sample is thus obtained which is given to the assayer.

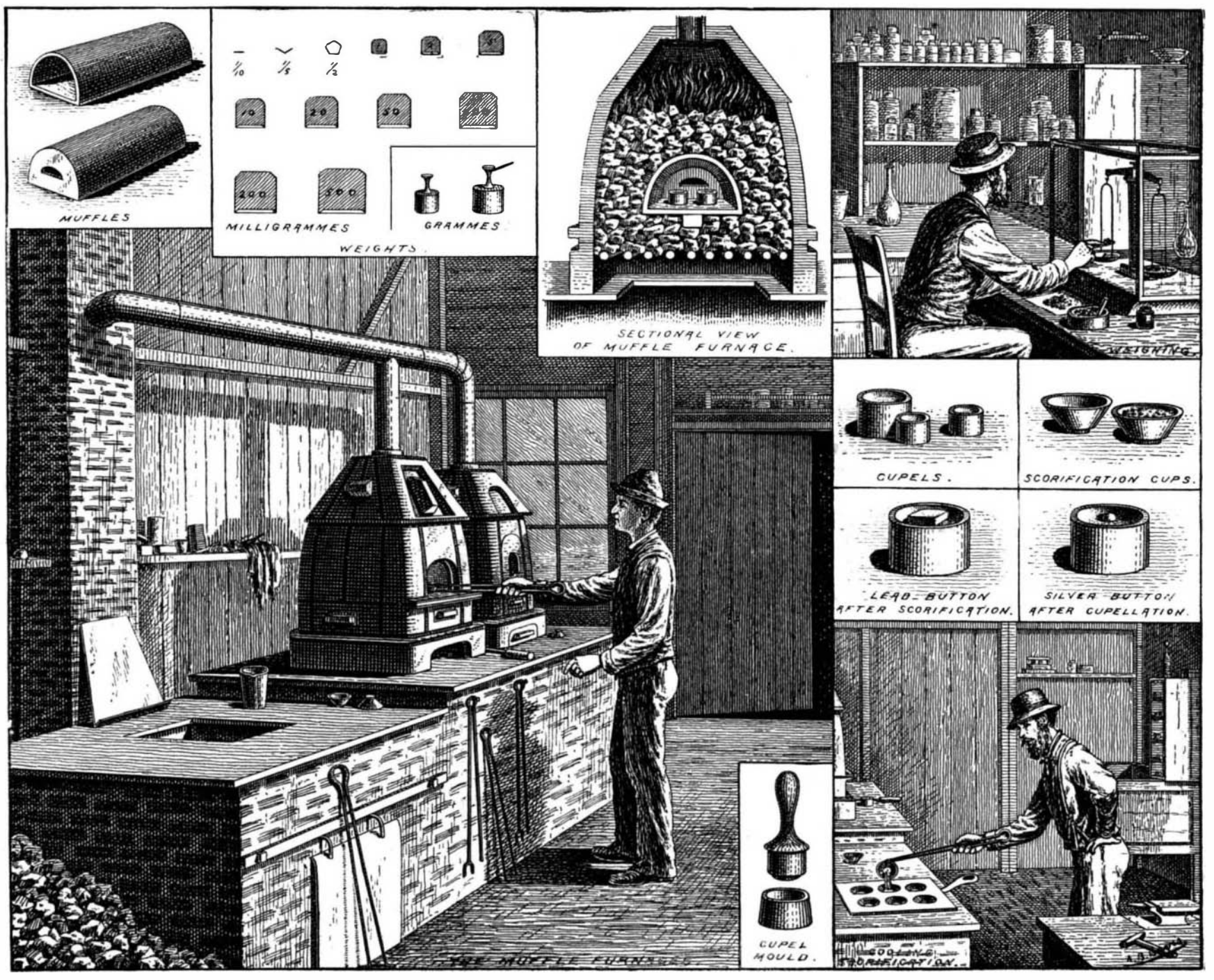
The first operation is to weigh out the powder. This must be done upon a fairly delicate balance. The quantity used for an assay depends upon the richness of the ore; it is very usual to base the weighing upon what is known as the assay ton, a weight of 29·166 grammes. One milligramme bears the same proportion to the assay ton that one troy ounce does to a ton of 2,000 pounds. In weighing, duplicate portions are weighed out representing from a fraction of one to several assay tons, according to the richness of the ore, and the operations are carried on in duplicate throughout. Each sample is mixed with from 8 to 16 parts of very pure, finely granulated lead, called "test lead," and a little borax glass. The fusion is often done directly in a scorifier. These are shallow clay cups about 2 inches and 2¾ inches in width. The weighed portion of ore with the borax glass and lead being placed in one of these cups, the whole is introduced into a hot clay retort known as a muffle, which is heated in a muffle furnace. Muffles and furnaces are shown in the cuts in sections and elevations. The heat is maintained at about 1,600 degrees. The lead in the scorifier melts and the ore floats on top of it, along with the melted borax glass. Gradually the ore disappears, its metallic constituents entering the lead and its earthy constituents forming with the borax glass a fusible slag. As a constant current of air is drawn through the muffle, the lead rapidly oxidizes and its oxide joins the slag, so that after a little while only a small circle of metallic lead appears in the center of the slag. This circle is gradually encroached upon, and eventually the slag covers over the button of metal, which at once sinks to the bottom and the scorifying is ended. After a little more heating the scorifier is withdrawn from the muffle and its melted charge is poured out into a hemispherical depression in an iron pan, in which it rapidly cools. When cold, a few blows of the hammer, the charge resting on an anvil, knocks the slag off. The spheroidal lead button is then pounded into a roughly rectangular shape, and is ready for cupellation.

The cupels are shallow cups of bone ash, about 1½ in. in height, 2¼ in. in width and ⅜ in. in depth. They are made by hammering in a mould, a hammer and piston being used to drive the material down into the cavity of the mould and compact it. The cupel is first heated in a muffle and the rectangular button is placed in it. It at once melts and begins to oxidize. As fast as the oxide of lead is formed, it melts and is absorbed by the porous bone ash of the cupel, as water is absorbed by a sponge. This operation goes on until little more than the silver is left. Just at this point, as the last of the oxide of lead disappears, a sudden flash of rainbow colors passes across the surface of the button, the "brightening" indicating the expulsion of the last of the lead. The silver button is now allowed to cool, is removed by a pair of pincers from the cupel, and when cleaned and brushed free of bone ash is weighed on an exceedingly sensitive balance. Each milligramme of weight represents an ounce or definite portion of an ounce per ton of ore if assay tons have been used. The balance used for this weighing is one of the most sensitive made, and can indicate the twentieth of a milligramme readily.

Should the ore contain gold, this is determined by "parting." The button is fused with one or two times its weight of pure silver. It is then rolled out into a thin sheet, and is treated with nitric acid. This dissolves the silver and leaves behind the gold and any platinum or similar metal which the ore may contain. This residue is weighed and is reported as gold.

The weights used, from the gramme upward, are usually made of brass, of the shape shown. From 500 milligrammes down to 10 milligrammes they are often made of platinum; the smaller weights are of aluminum, the fractions of a milligramme being made of wire bent so that the number of sides in each bent wires indicates the number of tenths of a milligramme which it represents.

There are, of course, many refinements and modifications in the process which it is not necessary to summarize here. The assayer acquires by practice so good a knowledge of ores that he can properly proportion his charge from the appearance of the ore alone. A large number of assays can be kept going at once, the scorifiers and cupels being marked with numbers designating the sample for assaying which it is used.



THE ASSAYING OF GOLD AND SILVER ORES.

American Copyright.

It is a great mistake to suppose that the copyright difficulty with America has been settled. The new American act comes into operation this day month, but we shall then be no better off than we are now. Before the British author can enjoy the benefits of the measure, such as they are, we are expected to give reciprocity to the American author, who is to be placed on exactly the same footing, as regards copyright, as the English writer. That would be fair enough were the conditions equal, but Congress has taken care that they shall be very far from equal. For an English book to obtain copyright in the United States it is essential that it should be printed there. Yet, in face of this, Mr. R. B. Marston appeals to Parliament to grant reciprocity to America. What Parliament ought to do is not to grant a ridiculously one-sided reciprocity, but to pass a measure of retaliation. Let us give copyright to the American author on precisely the same terms that America offers it to the Englishman. Nothing can be fairer than that.—*St. James's Gazette*.

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