THE NEW YORK ASSAY OFFICE.

As is well known, the United States is one of the most important gold-producing countries in the world. The amount of gold produced in the calendar year 1899 was 3,437,210 ounces fine, of the value of $71,053,-400, this being exceeded only by Australasia, which furnished $79,321,581, and Africa which produced $73-227,108. The total production of the various colonies and countries in these continents, including the United States, was 10,820,000 ounces fine, having a value of $223,600,000, making 73 per cent of the product of the world. The output of the United States in 1899 is the largest in its history, exceeding by $6,053,400 the estimated product for 1853, the record year following the discovery of California placers. The gold, however it may be obtained, is put upon the market by private refineries, by the Mint and Assay offices. During the calendar year, 1899, the domestic product in fine bars reported by private refineries amounted to 2,434,248 fine ounces, while unrefined gold of domestic production, deposited at the Mint and Assay Office amounted to 999,504 fine ounces.

The production of silver during 1899 was also a considerable amount, amounting in value to $32,858,700. The Mexican product amounted to $33,367,300. Geographically the world's output of silver in 1899 is distributed as follows: North, Central and South America, $83,400,000; Europe, $8,300,000; Australasia, $7,-600,000; Asia (Japan) $1,000,000, making a total of $100,300,000. The value of the gold coinage for the fiscal year 1899-1900 was $107,937,110. The value of silver dollars was $18,244,984. The coinage of subsidiary silver pieces amounted 57,114,270 pieces of the value of $12,876,849.15 and of mining coins to the extraordinary total of 101,301,753 pieces of the value of only $12,243,017.21. We have already outlined, in the SCIENTIFIC AMERICAN for September, 7, 1901, the operations carried on at one of our mints, and we now take up another phase of the subject which is as interesting, the Assay Offices, the one which we select being located at New York. The importance of the Assay Office in its relation to the financial world, the Treasury and the Mint cannot be over-estimated, and the process of melting and refining of bullion will form the subject of a subsequent article.

During the fiscal year ending June 30, 1900, the fineness of 11,802 melts of gold and silver deposits, 993 melts of fine gold and silver, also 1,050 melts of mixed metal, about 500 special deposits, 350 barrels of sweeps, 83,178 gold and silver bars were estimated, and about 60,000 cupels and the necessary "proof" gold and silver were made.

The Assay Office in New York was established by law in 1853, and was opened in the autumn of 1854. The first Assayer of the New York Assay Office was Dr. John Torrey, of Columbia College, who was appointed in 1854 and held his position until 1873. On his death he was succeeded by his son, Mr. Herbert Gray Torrey, who has been in office for forty years. The Superintendent of the Assay Office is Andrew Mason, who was appointed to his present position in 1883, having previously been Assistant-Assayer and Melter and Refiner. While holding the latter office he substituted the use of sulphuric for nitric acid in the refining process, which will be described in a subsequent article, thus saving this one Assay Office $100,-000 per annum.

The United States Assay Office is located in a low modest-looking marble building located beside the more imposing Sub-Treasury building at the intersection of Wall and Broad Streets, which marks one of the most historic spots in the country, namely, the site of the old Federal Hall where Washington took the oath as first President of the United States. Although the building is small, yet it only masks a really large, inner building surrounded on all sides by office buildings and the Sub-Treasury. The Assay Offices, and particularly this one, have an important position in the world of finance, for here the precious metals —gold and silver—in all forms and conditions of fineness are assayed and refined. In brief, the work of this office consists in assaying or determining the value of gold and silver, in whatever form presented, as coin, jewelry, or in any other shape. Any one wishing to have gold or silver assayed in quantity or wishing to sell to the government, may present his property at the Assay Office, where he may have the metal reduced and made into bars, or if he prefers, he may sell his bullion direct to the government.

The charge for doing the work is merely nominal, and is based on the actual cost. Millions of dollars are stored at all times in the vaults, and at the time our photographs were taken, the amount of gold and silver was about $40,000,000. When the precious metal is received, the first step consists in weighing the coin, bars, jewelry or tableware. This is done with great exactness and a receipt is given. Each person's holdings are placed in a box and are taken to the melting room, where they are placed in crucibles with a flux and smelted and cast in ingot molds, the pouring being a highly picturesque operation. A small chip is taken from the bar for assay.

The chip is taken to the Assay room, where a hydraulic press reduces the sample to a size which permits of it being run through drawing rollers, so that the sample may be cut from the ribbon with the weight of one gramme. This is placed in a small unglazed earthen cup termed a "cupel," and a known quantity of silver, copper and lead is added before firing, for the following reasons: The function of the lead, which is in the form of a thin sheet, is two-fold; first, it serves as an envelope to hold the particles of bullion, silver and copper together, while melting, and the lead also oxidizes freely, dissolving the copper oxide and making it possible for both oxides to be absorbed by the porous body of the cupel. Silver is added so that the proportion of silver in the sample of bullion shall be approximately two of silver to one of gold, and that in the subsequent acid bath the gold shall not surround or mask the silver so as to prevent it from dissolving. In cooling the "button" which remains in the cupel after firing is apt to spurt up, thus wasting a portion of its weight and destroying the value of the assay. The lead oxide assists the copper oxide to be absorbed by the cupel. The cupel and its contents are now placed in a muffle furnace, and heated for a period sufficient to insure complete melting. If there be any copper or lead present in the sample, they will become alloyed with the copper and lead added by the Assayer, and will become oxidized and absorbed. The gold and silver, together with the known quantity of silver which has been added by the Assay Office, remain in the cupel in the form of a "button." Each button is placed in a special tray which keeps each sample by itself and is then flattened and rolled, boiled in nitric acid, 32 deg. Baume, for ten minutes, and then in fresh acid for ten minutes more. The silver is dissolved by the acid, forming silver nitrate, while the gold remains intact because only nitro-hydrochloric acid, so-called "aqua regia," dissolves it. Gold is left in the flask and is washed and weighed. The loss of weight in the furnace is base metal—lead and copper. The loss of weight in the nitric acid is silver, and the remainder is gold. In the case of silver bullion it is subjected to the humid test as well.

So far the government has been acting as an Assayer, but if the depositor wishes to part with his bullion, which is now of known value, the government pays for it at the prevailing price and proceeds to separate or part the gold from the silver. This operation will be described in a subsequent article. The price of gold never varies, costing $20.67 a fine ounce. Silver fluctuates with the market.

Electrolytic Apparatus for Hydrogen and Oxygen.

The Schuckert Company, of Germany, has lately brought out an electrolytic apparatus for producing hydrogen and oxygen on an industrial scale, and it is claimed that the gases can thus be produced very easily and economically. The apparatus has the form of a series of tanks or reservoirs, above which are the bell-shaped receptacles for the gases. Both tanks and receptacles are constructed of cast iron, and only the electric conductors are of copper. A solution of 15 per cent caustic soda in water is used for the electrolyte and the voltage is from 2.8 to 3 volts for each apparatus. A number of the latter are generally used, and are connected in series. The solution is kept heated to a temperature of 70 deg. C. during the action and an electric heating device is used in the present case, although if steam heat is available the heating is of course much more economical. Each of the gases, given off at its electrode, is accumulated in the bell-shaped receiver, and where a number of apparatus are used the receptacles for each gas are all connected by a common tube. The gases are passed into a washing chamber, which retains all traces of soda which may be brought over. With proper precautions it is possible to obtain oxygen and hydrogen of 97 or 98 per cent purity. A great advantage of the electric apparatus is that the production of gas may be instantly controlled to any desired point and stopped at will. Each element contains about 10 gallons of soda solution and takes a current of 600 amperes. It weighs about 500 pounds. A tank of this capacity will produce per hour 55 gallons of hydrogen and 28 of oxygen at the ordinary temperature and pressure. An outfit for producing 100 cubic yards of oxygen and 200 of hydrogen per 24 hours contains 40 of these elements and is estimated to cost $4,500. When the current is furnished by a hydraulic plant, the figures show that the gas can be produced as low as 25 cents per cubic yard, or 50 cents if it is to be compressed in tubes for shipment.

A project is on foot to make gas near coal mines and pump it 124 miles to Paris. It would be sent highly compressed, and the pressure would be reduced for consumption. It is expected if this project is carried out that gas can be supplied for 28.7 cents per 1,000 cubic feet to the city, 57½ cents for private lighting and 34½ cents for use as fuel.

Automobile News.

Now that road races are forbidden in France, automobilists have taken to hill climbing and mile and kilometer events.

Automobiles across the Caucasus for carrying the Russian mail are to supplant the present transport post-horses, with changes every ten miles.

Automobile cabs are again demonstrating their usefulness in New York and other cities during the inclement weather when horses are so often helpless.

The Automobile Club of Great Britain proposes to establish a motor-car school for the teaching of motor-car driving, at which members and their servants can learn driving and the management of motor vehicles, and from which thoroughly respectable and competent servants will be obtained. In England at the present time there are very few automobilists who possess more than the most elementary knowledge of motor-car driving or the management of a vehicle.

The Automobile Club of London some time ago offered a prize of $600 for a device to overcome the dust nuisance caused by pneumatic tires. The judges were Prof. Vernon Boys, F.R.S., and Mr. Worby Beaumont. The suggestions for remedying this grievance, however, have been so disappointing, and the schemes submitted so impracticable, that the judges have declined to make an award. However, the club have extended the period of the competition until the beginning of June, by which time it is to be hoped some palliative of this great drawback will have been discovered.

The idea of constructing a special road for motor cars from London to the South Coast of England has been mooted. Mr. George Lowithain, a well-known civil engineer and enthusiastic motorist, is interested deeply in the scheme. He suggests the construction of a track 80 feet wide, paved with 4 inch granite cubes laid on pitching with a covering of concrete sufficient to prevent settlement of the paving sets into holes or ruts. Such a road would approximately cost $260,000 per mile. The cost of a macadamized road laid on stone pitching [illegible]d well grouted and rolled with a steam roller would be about $135,000 per mile.

One of the greatest difficulties encountered by automobile drivers is in connection with the water circulation. Pump troubles are so frequent that one or two English manufacturers have endeavored to surmount the obstacle by a system of air cooling. But the idea is generally condemned. Yet in a recent run from London to Southsea, a distance of approximately 70 miles, three 10 horse power cars equipped with the air-cooling apparatus covered the journey without the slightest hitch, and when they arrived at their destination were in perfect condition. At no part of the journey were any signs of those troubles generally conceded to be characteristic of the air-cooled motors observed, and, in fact, these particular automobiles conclusively proved that the system could be utilized in lieu of the pumps. In view of their conspicuous success on this occasion these three cars are to be submitted to further exacting trials to substantiate the advantages of the air-cooling system.

Some important brake trials have been made by the Automobile Club of Great Britain on a private road in the grounds of Welbeck Abbey for the purpose of obtaining conclusive data of the space within which motor vehicles can be stopped when driven at high speeds. The road had a steady gradient throughout the measured mile run, selected for the tests, of about 1 in 60. The cars were timed over the full mile, and also over the last one-twentieth of the mile (88 yards), in order that the speed at which the cars were traveling at the end of the mile might be ascertained. As the front wheels of the cars passed over the tape at the end of the mile their brakes were applied, and when they came to rest the distance from the tape of the point at which the front wheels rested when the car stopped was carefully measured. The stopping of the cars on the flat, on a hard, dry road, showed that at the undermentioned speed the cars could be stopped on an average in the following number of lengths; a length for this purpose was calculated to be 11 feet 8 inches, as that was the average length of the cars engaged in the trial.

Miles per hour.

1. 11 to 14, 1 4-5ths times the car's length.
2. 15 to 17, 2 times the car's length.
3. 18 to 20, 2¾ times the car's length.
4. 20 to 24, 3½ times the car's length.

The figures given above are averages. As a matter of fact, one car traveling at 13 miles per hour was stopped in 4 yards; another traveling at 18½ miles per hour was stopped in 7 yards; and a third when going at 20 miles per hour was stopped in 12 2-3 yards. The average weight of the vehicles without passengers was 24 hundredweight. From these results it will be seen that motor-cars can, on an average, be stopped, when traveling at 20 miles an hour, in less distance than the ordinary horse vehicle can be pulled up when traveling at 10 miles an hour.

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ASSAYING GOLD AND SILVER BULLION AT THE NEW YORK ASSAY OFFICE.—[See page 107.]