

WHERE OUR COINS ARE MADE.

MINTING AT THE ROYAL MINT, PRETORIA.

ORIGIN AND EVOLUTION OF COINED MONEY—ACTS ESTABLISHING THE PRETORIA MINT—MAJOR ITEMS OF PLANT—OPERATIONS OTHER THAN COINING—ASSAY OF GOLD AND SILVER BULLION—STAFF ORGANIZATION—COINING PROCESSES—FINAL OPERATIONS.

By R. PEARSON, Deputy Master.

THE site on which the Mint is erected has many historical associations, and a short account may be appropriate.

In early times—the days of the Voortrekkers—the men of a large Boer trek camped between the present Burgers Park and Market Street, ran up a small loop-holed outpost to reassure the women and children when left alone, and also owing to a visit from several lions attracted by the herds. Four or five of these visitors were bagged by the hunters and laid out for inspection near the Mint site. Mr. Hendrik Pretorius was in this trek and witnessed the hunt. In 1875 the Central Gaol of the Transvaal Republic was built upon the site, and in the Anglo-Boer War of 1880–81 this, together with the Convent, was fortified, forming the Convent Redoubt, and, under Major Le Mesurier, sustained a siege lasting four months, and had not been reduced when the war terminated. The reform prisoners, or “Jameson raiders,” were incarcerated in the Gaol in 1895.

I am indebted to Sir Johan van Boeschoten, Mr. Hendrik Marais, Colonel Du Toit, and the late Mr. T. W. Beckett for much interesting history of those early days.

During the building of the Mint it was frequently visited by a real “ghost,” presumably that of a former inmate of the Gaol; this ghost was of a very practical turn of mind as it showed a preference for dressed timber, carpenter’s tools, etc., and was finally laid by the South African Police.

Origin and Evolution of Coined Money.

I think it will be of interest to make some reference to the origin and gradual evolution of modern coined money. Barter was in early times, and still is in some out-of-the-way places, the means of exchange, but, as commercial transactions became more complicated, its inconvenience increased. At the present time if one wished to barter, say, a silk hat for two boxes of cigarettes, it would not be an easy matter to find a Pretoria tobacconist who was yearning for a silk hat. An instance is quoted by Professor Jevons of a French singer who, when making a tour of the world, gave a concert in the Society Islands—her share of the receipts was 3 pigs, 23 turkeys, 44 chickens, and 5,000 coconuts. Barter, in this instance, produced somewhat inconvenient results and not exactly what the lady desired in the way of recompense. As the inconvenience of barter increased, a demand arose for some recognized and to some extent universal medium of exchange, and it was probably the Greeks, about 700 B.C., who minted the earliest coins, although there is strong evidence and a definite statement is made that a coinage was instituted in China as far back as 1091 B.C. by Cheng, the second King of Chow. The Greek coins were made from electron, a natural alloy of gold and silver. Electron, however, was not always of the same composition, and about 561 B.C. a double system of gold and silver was instituted, with weights so calculated that the two

metals were readily exchanged. The idea of stamping with a device no doubt arose from the ancient practice of sealing, and was evidence of good faith. From these olden days up to comparatively recent times coins of various kinds have been minted by Governments and by private individuals, and in both cases dishonesty often crept in, and coinage was clipped and debased for the benefit of the Government or individual issuing it. On the whole, England was more fortunate in this respect than some other countries. Under William the Conqueror there were about seventy mints scattered over the country under Royal supervision, and counterfeiting was punishable by personal mutilation. A searching investigation was ordered by King John in 1207, when the whole of the staffs of the various mints, including workmen, were ordered to proceed to London and bring their dies with them, a practice which might with great pleasure to Mint officials be instituted nowadays; but there was only one cure for bad coinage and abuses, viz., centralization, and eventually all coinage operations in Britain were conducted under strict supervision at Tower Hill. The Royal Mint, London, as now constituted, dates from 1817, and the buildings from 1810. It is often asked why the head of the Mint is styled Deputy Master; in 1870 the Coinage Act abolished the ancient post of Master of the Mint as such and combined it with that of the Chancellor of the Exchequer, who is always ex officio the Master of the Mint, consequently the appointed head is Deputy Master. The first known Master or Warden of the Mint dates from the time of Henry I.

Acts Establishing the Pretoria Mint.

The Pretoria Branch of the Royal Mint was established on 1st January, 1923, by Royal Proclamation dated 14th December, 1922, in pursuance of the Coinage Act, 1870, as amended by the 1891 Act, also by the Union Acts, the Pretoria Mint Act, 1919, and No. 31, 1922, "To provide for currency coinage and legal tender." Under the Proclamation the Mint may coin gold coins of the same denominations, designs, weight, and fine-

ness as those coined at the Mint, London, and such coins are current and legal tender in the same manner and to the same extent as those coined and issued in England. This provision applies also to the Mints in Australia and the Mint in Canada. It also instructs the Deputy Master to coin into sterling gold coins any gold bullion (subject to certain conditions as to "finesness," etc.) which any person may bring to the Mint; the charge for this work is 1½d. per ounce where the amount does not exceed 500 ounces standard, and 1d. in any other case. These charges are paid to the Union Government under the Union Currency Act. The Minister of Finance authorizes the making and issue of silver and bronze coins of the Union, and bearing distinct designs; all profit on this coinage is also paid to the Union Treasury. At present the profit accruing to the Union Government is the result of withdrawing British .925 standard silver and converting it into Union coin, the British Government paying the difference between the nominal and bullion value. In the period 1st January, 1923, to 31st December, 1924, this, in round figures, amounted to £240,000, after deducting working expenses and interest.

Two essential requirements for modern minting operations are a supply of pure metals and very accurate machinery for the proper working of these metals. Gold must be pure and malleable, silver the same, and the alloy copper must conform to certain rigid tests and be not less than 99·8 per cent. pure, as also the tin and zinc for bronze coinage. These specifications also apply to other coinage metals, such as nickel, aluminium, cupro-nickel, etc. Gold is generally found distributed in minute particles throughout a mass of rocky material. There are instances when it is found in "chunks." In the early gold history of Western Australia masses of gold were found containing quartz, but these cases are rare. On the Rand it occurs in the proportion of 1 part gold to 6,000 parts of ore, often the proportion of rock is greater. The skill and care required to obtain this minute quantity

of gold may be appreciated by visualizing the operation necessary to recover a teaspoonful of sugar which had been carefully mixed with a Scotch cart load of sand. The successful handling of these ores of low gold value is a very remarkable achievement. The gold bullion as it leaves the mines is not sufficiently pure to be used at once, as it contains in some instances as much as 50-60 per cent. base metals and silver; the bars obtained by the cyanide process are generally 85-90 per cent. gold, 8-10 per cent. silver, with varying quantities of base metals, lead, tin, zinc, antimony, arsenic, etc., and in some instances, particularly from the Rand, the comparatively rare metals, platinum and iridium. The base metals and silver must be removed by one of the many refining processes used by modern refiners: the Miller chlorine process, the electrolytic, or, what is generally the most economical, a combination of the two. It may be of interest to mention that, owing to various difficulties regarding transport, etc., large quantities of South Africa bullion accumulated in the Union during the war, and were eventually dispatched by cruisers to Canada, and then to the Royal Mint at Ottawa, where it was refined and delivered in New York at the rate of $1\frac{3}{4}$ tons of fine gold bars every sixteen hours. The rapid casting of these bars necessitated melting in large quantities, and, after some experimenting, individual melts of 800-lb. weight were found practicable, although it was with some inward quakings that the first lot was poured into the moulds, as an accident with a mass of molten gold weighing more than $\frac{1}{2}$ ton would make rather a mess; fortunately, no accident ever occurred.

As an instance of the willingness of the Canadian workman to "put his back" into a job when necessary, a refinery was built, equipped, and ready for work in fifty-six days after the foundation was commenced; a normal time would be, say, five months. Gold was concentrated in Ottawa at that time from India, China, Japan, Russia, Borneo, South America, and last, but by no means least, from South Africa.

Practically all fine gold bullion delivered for coinage comes from the Chamber of Mines Refinery at Germiston, where the whole output of the Rand is refined. The Mint has purchased fine silver bullion for coinage purposes from this refinery when necessary, to meet demands. The silver bullion is recovered from the raw gold during the refining processes.

Major Items of Plant.

The major items of machinery required for coinage are (after the bars are produced in the melting-house, referred to below) heavy rolling-mills, powerful presses to punch out the "blanks," marking machines for thickening the edge of the blank, annealing furnaces, washing and drying plant, coining presses, automatic weighing-machines, medal and die presses, and heavy bullion balances for checking the weight of metal in process of manufacture at all stages; also a fully equipped mechanics' shop for effecting repairs and making new parts, accurate tools, etc. One machine in this shop is used to regrind the rolls as they become worn, and is adjustable to $1/10,000$ inch.

Operations of the Mint other than Coining.

The operations of the Mint are not confined to coinage, but include the manufacture of medals and dies. Recently, stamped metal badges for vehicle and dog taxes have been undertaken. This work was formerly done in Europe, with a consequent loss of revenue and employment.

Assay of Gold and Silver Bullion.

"The Metallurgy of Gold," by Sir T. K. Rose, chemist and assayer of the Royal Mint, London, says:—

"The 'parting assay' was first mentioned in a decree of King Philippe, of Valois, published in the year 1343. The methods of procedure in the sixteenth century have been described by Agricola and by Ercker, and those in the seventeenth century have been briefly described by Savot and by J. Reynolds, and more fully in the *Compleat Chymist*. In 1666 Pepys saw the parting assay being practised at the Mint in the Tower

of London, and from his description it is clear that the method then employed bears a surprisingly strong resemblance to that of the present day."

The ordinary procedure of an assay office has been the subject of much investigation, and, as a result, refinements have been added until it has become one of the most accurate of any chemical or metallurgical processes. The assays resulting from these methods may be accurately stated to $\cdot 1$ part per 1,000. The system adopted may be divided into six operations:—

- (1) Selection of the sample.
- (2) Preparation of the assay piece for cupellation.
- (3) Cupellation.
- (4) Preparation of the assay piece for parting.
- (5) Parting and annealing the cornets.
- (6) The final weighing and reporting.

The sample is taken either by cuts or drillings from top and bottom of the ingot after melting or, if the composition is not uniform, by "dipping" out a small quantity of the molten metal; in some cases both methods are used, and with base bullion it is often "toughened" or partially refined before a reliable sample is obtained. This is particularly necessary in the presence of metals which cause segregation, lead, tellurium, etc. A portion of the sample, $\cdot 5$ gramme, is accurately weighed on a balance which clearly indicates a difference in weight of $\cdot 1$ per 1,000, or $\cdot 05$ milligramme; it is usual to have the balance so adjusted that one sub-division on the ivory scale corresponds to this quantity. After noting the weight, the sample is enclosed in pure lead foil, together with some copper (unless already in the sample) and pure silver in the proportion of $2\frac{1}{2}$ times the weight of gold present. Cupellation is carried out in a muffle furnace in which the admission of air is under control; when cupellation, which removes base metals, is finished, the "buttons" of gold and silver are cleaned, "flatted," rolled into strips, and then coiled into a spiral. Each spiral is placed in a platinum cup held in a platinum tray, the whole is plunged into hot nitric acid and boiled

to remove the silver, the gold remaining in its cup as a "cornet"; the cornets are dried and annealed at a dull red heat. During these operations there are minute losses of gold, due to volatilization, solution, and absorption in the cupel; there is also a retention of silver and occluded gases in the "cornet"; the algebraic sum of these losses and gains is the "surcharge," and is ascertained by distributing throughout the "fire" of assays certain pieces of gold, the exact fineness of which is known; these are called "checks" or "proofs," and as they have passed through all the operations mentioned a correction or "surcharge" is obtained. The "cornet" is weighed on an assay balance, and this weight, after correcting for the "surcharge," represents accurately the gold-content of the sample. Silver assays are made by the Gay-Lussac method, in which a weighed quantity of the sample is dissolved in nitric acid and the silver precipitated by a solution of common salt-sodium chloride of known strength; each cubic centimetre of the salt solution corresponds to a definite amount of metallic silver; the number of cubic centimetres required to precipitate all the silver represents the percentage of silver present. The above is a very curtailed account of the assay processes, as to go into all details would require a volume.

Staff Organization.

The Mint workmen, all of whom were obtained locally and trained in the Mint, are classed as follows:—

Grade I craftsmen, established and pensionable, and include first-class mechanics.

Grade II craftsmen, unestablished, who are not necessarily tradesmen.

Apprentices, who serve five years in all departments of Mint work and then become improvers. If they have trades school experience their term of apprenticeship is proportionately decreased.

Many youths who, without the apprenticeship, might eventually augment the class of unskilled workers, are enabled to become skilled craftsmen. In addition,

selected natives are employed for work to which they are suited, and which they perform admirably. Each department has its foreman, who is a man of wide

experience in his own province, and each department again is supervised by a technical officer responsible, through the Superintendent, to the Deputy Master.

STATEMENT OF REVENUE AND EXPENDITURE TO 31ST DECEMBER, 1924.

<i>Revenue.</i>		£	s.	d.	<i>Expenditure.</i>		£	s.	d.
Gold charges.....		8	2	9	Capital outlay on buildings and machinery, etc.....	233,726	18	11	
Net profits on silver coinage	301,799	14	9		Establishment charges, materials, etc.....	54,277	9	6	
Medals and miscellaneous work	432	12	8		Net revenue to Union Government at 31st December, 1924	14,236	1	9	
		<hr/>					<hr/>		
		£302,240	10	2			£302,240	10	2

VALUE OF COINS ISSUED TO THE 31ST DECEMBER, 1924.

	1923.		1924.		Total.	
	£	s. d.	£	s. d.	£	s. d.
Sovereigns.....	518	0 0	3,195	0 0	3,713	0 0
Half-sovereigns.....	55	0 0	273	0 0	328	0 0
TOTAL (GOLD).....£	573	0 0	3,468	0 0	4,041	0 0
Half-crowns.....	146,247	2 6	326,438	2 6	472,685	5 0
Florins.....	69,522	2 0	149,305	10 0	218,827	12 0
Shillings.....	26,689	6 0	60,599	0 0	87,288	6 0
Sixpences.....	908	2 6	7,993	14 0	8,901	16 6
Threepences.....	716	2 9	7,018	7 6	7,734	10 3
TOTAL (SILVER).....£	244,082	15 9	551,354	14 0	795,437	9 9
Pence.....	98	19 3	471	9 9	570	9 0
Halfpence.....	7	1 0	98	7 11½	105	8 11½
Farthings.....	14	19 2½	65	19 10½	80	19 1¼
TOTAL (BRONZE).....	120	19 5½	635	17 7¼	756	17 0¾
TOTAL.....£	244,776	15 2½	555,458	11 7¼	800,235	6 9¾

ANNUAL CAPACITY FOR COINAGES OF VARIOUS DENOMINATIONS.

(Estimates given must be taken as approximate.)

- (1) *Gold coins* (assuming no silver or bronze coinages)—
- | | |
|-----------------------------|------------|
| | Coins. |
| (a) Sovereigns..... | 10,000,000 |
| or (b) Half-sovereigns..... | 7,000,000 |
- (2) *Silver and bronze coins* (c) (assuming no gold coinages)—
- | | |
|------------------|------------|
| Half-crowns..... | 4,500,000 |
| Florins..... | 3,500,000 |
| Shillings..... | 2,000,000 |
| Sixpences..... | 1,500,000 |
| Threepences..... | 1,000,000 |
| Pence..... | 1,500,000 |
| Halfpence..... | 1,000,000 |
| Farthings..... | 1,000,000 |
| | <hr/> |
| | 16,000,000 |

NOTES.—(1) By making special arrangements as to the working of overtime in certain sections the above figures could be increased to—

- (a) 12,000,000 coins.
 (b) 9,000,000 „
 (c) 19,000,000 „

(2) By the addition of certain items to the existing plant, but without increasing the size of the present building, the above figures could be increased to—

- (a) 20,000,000 coins.
 (b) 14,000,000 „
 (c) 25,000,000 „

With overtime in certain sections these figures could be increased to—

- (a) 24,000,000 coins.
 (b) 17,000,000 „
 (c) 30,000,000 „

silver coins are weighed individually on automatic balances to make sure they are of standard weight as specified in the Coinage Act. These machines are very accurately adjusted, and are sensitive to a variation of 1/100th grain. Counting into bags is done by a "counter" or "telling" machine, which is so adjusted that it stops immediately the required sum, say, £100, is delivered.

The assay of the "pyx" referred to above is a test of the weight and composition of the coinage. The "pyx" coins are selected at random from a "journey" (720 ounces of coin) and sent to the assay office for report before the coin leaves the Mint. "Journey" is one of the many old terms used in the Mint whose origin is very obscure. In the case of gold coins, an additional test is made annually in London, at the "Trial of the Pyx," of samples from all the gold coinage during the year. This trial is held at the Goldsmiths' Hall, and probably takes its name from the Pyx Chapel, at Westminster Abbey, and is the modern practice of an ancient ceremony in use in Saxon times. Dean Stanley, in "Memorials of Westminster," says, referring to the Pyx Chapel: "It was probably almost immediately after the Conquest that the Kings determined

to lodge their treasure under the guardianship of the inviolable sanctuary which St. Peter had consecrated and the bones of the Confessor had sanctified." Nowadays it is considered wiser to rely upon strongrooms of steel and reinforced concrete.

The half-crown has now passed through all the necessary operations and tests, and is ready to proceed to the pockets of the public. In this connexion it may be mentioned that many people have the erroneous impression that a Government makes unlimited subsidiary coins in order to obtain the "seigniorage" or profit; such is not the case; the Mint can only put in circulation what is demanded by the public.

A noticeable feature in South Africa is that, apart from the Cape Province, there is little inclination to use the half-penny, notwithstanding "hard times." A charge of 3d. is made for an article which could be sold profitably at 2½d.; the additional ½d. represents 20 per cent. In British Columbia, fifteen years ago, the ½d. or 1 cent piece was scorned—no one wished to be bothered with anything less than 5 cents = 2½d.—but in the past ten years the 1 cent has become an important coin.

