Port Pirie. The outer portion rapidly takes up water of hydration slacking into powder; the slightly sintered lumps from the centre will also crumble into powder if exposed to the weather for a considerable time.

Mr. Delprat gives the following interesting analyses:—*

	Before sintering.	After sintering.
Lead	17 per cent.	14.5 per cent.
Zinc	16 ,,	12.5 ,,
Sulphur . ..	12.5 ,,	7.1 ,,
Silver	17.5oz. per ton	15.8oz. per ton

About two-thirds of the sulphur is as sulphate and the remainder sulphide.

The losses in this sintering heap roast are approximately—

Lead	19 per cent.
Zinc	29 ,,
Silver	15 ,,
Sulphur	45 ,,

It is seen that while the desulphurisation is only moderate, the metal losses are very high, and much beyond what is to be expected; but the cause of such high losses is not clear. Although the loss of values is high in heap sintering, the product is one that can readily be treated in the blast furnaces, as the desulphurisation is sufficient, and the physical condition is excellent. On the other hand, these slimes do not roast well in mechanically-rabbled furnaces. They cause much dusting, and are by themselves untreatable by the Huntington-Heberlein process in use at Port Pirie. When more than a moderate amount of these slimes is mixed with ordinary lead concentrates, they prevent a satisfactory sintering in the Huntington-Heberlein process. As explained elsewhere, they give a satisfactory desulphurised and sintered product by the Carmichael-Bradford process. As this process is being installed, and is to be worked on a large scale at Port Pirie, it is probable that a large quantity of slimes will be treated by it, the extra cost of treatment being more than compensated by the improved recoveries of lead and silver.

Pot-Roasting Reactions.

The reactions which take place in the Huntington-Heberlein and similar processes has been the subject of much discussion, in which there has been far from a unanimity of opinion. The patentees of the Huntington-Heberlein process, in their specification, claimed that—

at 700° $CaO + O = CaO_2$

at 500° $4CaO_2 + PbS = PbSO_4 + 4CaO$

or $4CaO + PbS + 4O = PbSO_4 + 4CaO$

$PbS + PbSO_4 + (O_2) = 2PbO + 2SO_2$

* Trans. Aust. Inst. of Mining Engineers, vol. xii.

As metallic lead is sometimes seen in the sintered product of the process, no doubt the well-known reaction between oxides, sulphides, and sulphates also takes place. This occurrence of metallic lead, however, seldom takes place, and then only to a small extent—

$$2PbO + PbS = 3Pb + SO_2$$
$$PbSO_4 + PbS = 2Pb + 2SO_2.$$

This explanation of the process has not been received with satisfaction, especially the reaction relating to the CaO_2, which is decomposed at a low temperature. In a later communication* the patentees claim that the action of the CaO is catalytic, in the same way as spongy platinum, metallic silver, or oxide of iron. They also pointed out that the process will work well with Fe_2O_3. This is certainly the case, as shown by the Kapp-Kunze modification successfully worked at Zeehan, and at the experimental plant at Chillagoe, and also more extensively in some of the installations in the United States of America.

There is little doubt that the reactions summarised by

$$PbS + 3O = PbO + SO_2$$

also take place in the heated mass, as in heap-roasting. It is also claimed † that the following reactions, resulting in calcium plumbate, take place:—

$$CaO + PbS = PbO + CaS.$$

and that the CaS is further oxidised to $CaSO_4$

$$CaO + PbSO_4 = CaPbO_3 + SO_2$$
$$CaSO_4 + PbS + 3O = CaPbO_3 + SO_2.$$

The presence of a fairly large percentage of silica is an essential to all pot-roasting processes, but its action and influence is rarely discussed. It forms silicates with iron and (or) calcium, and probably also with part of the lead, zinc, copper, &c., present in the various processes. In discussing the reactions, those leading to desulphurisation are mentioned, whereas those leading to the scorification and sintering of the charge are nearly always neglected. Besides desulphurising, the object of these processes is to obtain a product in a physical form suitable for blast furnaces—*i.e.*, as lumps, not as fines. Desulphurised fines can be readily obtained by roasting in reverberatory furnaces.

The presence of water is also beneficial in these processes. It is taken up by the $CaSO_4$ of the Carmichael-Bradford process. Its addition as a wetting of the charge is a special feature of the Savelsberg and McMurtry-Rogers processes, and in the Huntington-Heberlein process it has been found beneficial to wet portion of the furnace-roasted product, and feed it on

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* Eng. and Min. Journal, 20th May, 1906.

† Donald Clark, "Aust. Mining and Metallurgy," page 440.

top of a bottom layer of hot material. In the Carmichael-Bradford process the patentee claims that the following reaction takes place:— $CaSO_4 + PbS = PbSO_4 = CaS$.

They also claim that $CaPbO_3$ is formed as a final product, and, in fact, much of the lead exists in that condition.

Savelsberg, ‡ in his patent specification, makes an interesting claim relating to the reactions due to lime, and these have not been disputed. They throw much light on the reactions of all the processes, using compound of calcium as an essential feature. He says:—"The limestone gives rise to chemical reactions. By its decomposition it produces lime, which at the moment of its formation is converted into calcium sulphate at the expense of the sulphur in the ore. The calcium sulphate at the time of slag formation is converted into silicate by the silica present, sulphuric acid being evolved. The limestone, therefore, assists directly and forcibly in the desulphurisation by the ore, causing the formation of sulphuric acid at the expense of the sulphur in the ore, the sulphuric acid then acting as a strong oxidising agent toward the sulphur in the ore." Calcium sulphate is formed during the furnace roast in the Huntington-Heberlein process, and its importance was overlooked. It is formed at an early stage of the pot-blowing of the Savelsberg process, and its significance recognised, and it is made one of the starting points of the Carmichael-Bradford process. There is no doubt that the reactions which take place are many and varied under the thermal conditions, which vary from warm to white heat, the latter taking place at the slagging of the material. The desulphurised and slagged portions of the charge, where action has ceased, are cooled by the cold air-blast.

Blast Furnace Operations.

As originally constituted at Port Pirie, there were eleven furnaces 212in. by 62in., and two furnaces 120in. by 60in. The height from tapping floor to feed floor was 20ft. 6in. The downtake flues took off from the sides of the furnaces, 6ft. below feed floor. The depth of the charge was about 11ft. Later on the feed floor was raised 4ft., increasing the depth of the charge by the same amount. This charge enabled a higher blast to be used, and greater capacity and closer recovery of values were obtained. The feed floor immediately surrounding each furnace was of cast-iron plates supported on wrought-iron girders, an oblong feed-hole being left over the centre of the furnace. More recently the downtake flue was replaced by a plate-iron hood, 4ft. by 8ft., over the furnaces, the lower end being slightly tapered, and projecting 3ft. into the body of the furnace and charge. This

‡ Ingall's "Lead Smelting and Refining," page 123.

comparatively inexpensive alteration increased the height of the charge by another 3ft., measured to the bottom of the flue, and 6ft. if to the floor, and has enabled still greater recovery of values to be made—viz., the recovery now being—

Lead*	95 per cent.
Silver	98 „

and at the same time decreasing the wall accretions.

The 212in. by 62in. furnaces had ten tuyeres on each side, the 120in. by 60in. six tuyeres on each side and one at the end. The side tuyeres projected 9in. into the furnaces, but it was long known that it made little difference if the ends of the tuyeres were burnt off, though they were considered useful in holding up the charge. The projecting tuyeres have now been generally discarded, the end being flush with the jackets. There are now eleven tuyeres on each side instead of ten, the end tuyeres being closer into the corners than formerly. Blast furnaces for lead smelting in Australia are usually considerably wider than those favoured in the United States. The penetration of the blast is very efficient in these wide furnaces.

Blast furnace practice in America has reached a position of exceedingly high efficiency if it is superior to that at Port Pirie and Cockle Creek, and we have good reason to think it has not surpassed them, even if it is their equal.

In the matter of blast penetration, an experimental furnace, built at Port Pirie to the ideas of the Huntington-Heberlein representatives, is of considerable interest. It was circular in shape, 7ft. 4in. in diameter at the tuyeres, and had vertical cast-iron water-jackets, 2ft. 10in. high, surmounted by a vertical ring of brickwork, 9in. thick by 14in. high, to connect the jackets to the brick shaft, which was 16ft. high, and increased in diameter to 11ft. 4in. at the feed floor level. The crucible pan was 10ft. 6in. diameter by 4ft. 6in. high, and the crucible was 2ft. deep below the jackets. The original arrangement of tuyeres was unusual—viz., seven tuyeres, 1in. diameter and 6in. above the bottom of the jacket, and eight tuyeres, 1.5in. diameter, 14in. above the bottoms of the jackets. The penetration of the blast was effective, but the capacity was smaller than a 120in. by 60in. furnace. The small tuyeres were replaced by 3in. diameter tuyeres, 9in. above the bottoms of the jackets, giving an increased capacity. The recovery of values was higher than the rectangular furnaces on the same charge, this no doubt being due to the large increase of area—viz., 125 per cent. between tuyere level and flue level, as against only 5 per cent. in the rectangular furnaces. Owing to the shortness of the jackets, considerable trouble was experienced, due to the burning out of the narrow ring of brickwork connecting

* Deprat, Trans. Aust. I.M.E., vol. xii., page 19.

the jackets to the main shaft. Trouble was also sometimes experienced owing to the charge slipping down into the crucible at the commencement of the campaign. The experiment showed that the furnace was readily workable with very high recovery of values, even though the tonnage was moderate. A properly designed furnace of this type—viz., with boshed jackets of greater height, and perhaps projecting tuyeres to hold the charge when blown in—would be exceedingly valuable for smelting ore containing high gold and silver values, and volatile constituents, such as antimony, &c.

The Port Pirie works are built on reclaimed salt swamp land alongside of the Port Pirie River. This is a good example where all the departments—viz., roasters, sintering plant, blast furnaces, refinery, and power plant—are all bulit on the same level. The Cockle Creek works are also so built, whereas the now abandoned Dapto works are on a series of steps. The one-level system of laying out large works has the great advantage of compactness, and the more ready access from one department to the other. The raw concentrates and sintered slimes are shunted up an inclined embankment and trestle to the smelter feed floor, and there unloaded from the railway trucks—the raw concentrates into supply bins for the roasters, and the sintered slimes direct to the furnaces—any excess being unloaded into large bins on the ground floor. Sintered concentrates, limestone, ironstone, and old slag are hoisted and tipped into bins above the feed floor by ærial hoist conveyers (locally termed "flying foxes"). Coke is also similarly hoisted on to a platform. The cost of hoisting is very low, and is much more than balanced by the reduced cost of handling the material on the feed floor, owing to its great accessibility and convenience in running the material from shoots into the charge barrows.

Charging.

Each charge totals about 2.5 tons. The charge barrows have a pair of high wheels, and hold about 500 to 800lb. of ore or flux. The ore, flux, and returned slag are tipped on to the feed plates, and shovelled into the furnace. They are brought in a regular order, so arranged that when fed in they are thoroughly mixed. The coke is, however, fed as a separate layer between each charge, this method having been found to give better results than when mixed through the charge. In order to preserve the layer feeding of coke on the large furnaces, the complete round of feeding consists of two charges, but with the full complement of coke fed as a single layer.

Fine material of any kind, except when in small proportion, quickly reduced the capacity of a furnace. Fine amorphous limestone had the most paralysing effect.

The quantity of coke in a charge appreciably affects the cleanness of the slags. A certain percentage of coke may effectively melt the charge, but produced a "dirty" slag—*i.e.*, one containing too high values—whereas a higher percentage of coke may have the effect of cleaning it, as shown by the following example—the average obtained by running several furnaces for several weeks on the same charge, but with varying percentages of coke:—

With 12·5 per cent. coke the slags contained	...	2·5 per cent. lead.
,, 14·0 ,, ,, ,, ,,	...	2·0 ,,
,, 16·0 ,, ,, ,, ,,	...	1·2 ,,

The slag is drawn off at both ends, and if the furnace is working well may be kept continuously running, the slag being trapped by a breast separator. Clean slag is run out into large bowls, two of which are carried on a four-wheeled truck, the pair of bowls holding about 1.6 ton of slag. The pairs of slag pots are hauled by horses to the dump and easily tipped, as they aré pivotted at about the centre of gravity of the full pot. Foul slag is wheeled out into the yard in hand pots, and afterwards fed as return slag to the furnaces. The large furnaces have two lead wells, both on the same side. The bullion is run out through a movable spout into moulds on a movable truck. The bars, 26 to the ton, are sampled, weighed, and sent to the refinery. The sampling is done as follows:—A small piece about the size of a large pea is picked out of both the top and bottom surfaces of each bar, the position of sample working diagonally across five bars placed together. This method of sampling is very quickly performed, and is of sufficient accuracy for inter-departmental records. A day's sampling is melted down, well stirred, and a dip sample taken for the general sample of all furnaces on the same charge. Each furnace also has a special dip sample taken each twelve hours from the lead well. These are essayed separately, to check the working of each furnace. Lead scraps and tapping floor sweepings are returned once a shift to their respective furnaces.

Runaways of lead occasionally take place at the most carefully managed furnaces. It is remarkable how few men take advantage of fairly well known property of lead—viz., that for a considerable range of temperature below point of solidification lead is brittle (loc. "rotten"), and can be broken up by bars almost as readily as oatcakes, the fracture of which it closely resembles at that stage. If the lead is broken up by bars as it solidifies, it can be readily hooked out of the way, and the mess cleaned up in a surprisingly short time. If it is allowed to get cold, it usually takes many hours to laboriously cut it up with hammer and chisel.

The blast for the furnace is supplied by large Green blowers, at a pressure of about 30 to 35oz. These blowers are being supplemented by three turbo-blowers.

The circulating water for the furnace jacket is salt water which has passed through the surface condensers in the power plant.

The flue dust obtained from the roaster, converter, and blast furnace flues is wetted down and fed into the sintering pots. Baghouse experiments for condensing fume have recently been undertaken in connection with the blast furnace flues. The results are reported to be so satisfactory that an installation will probably be built to treat the whole of the gases now passing up the stack.

An interesting experiment was made to test the difficulties of smelting sintered slimes without other ore or sintered concentrates. Ironstone and limestone were added to give a slag approximating to that normally obtained. The percentage of zinc was, however, considerably higher. The result was successful, except in the essential item of recovery of values. It was found that there were no furnace difficulties in merely smelting the material—the furnace ran considerably faster than usual, giving a hot and very liquid slag. This high temperature was undoubtedly due to the unusually large amount of uncombined siliceous matter forcing a much larger amount of the charge to reach a higher temperature before fusing, and thus raising the average temperature of the slag. In an ordinary charge of Huntington-Heberlein material, much of it, including the returned slag, has already been more or less fused to silicates, and therefore a proportion of the charge melts and runs down as soon as the temperature in the blast furnace is sufficient, without being forced up to the temperature of the formation of silicates. For this reason charges of Huntington-Heberlein sintered material, or ore containing a high percentage of zinc, should contain sufficient uncombined silica so as to produce a high temperature slag, but at the same time this slag must be high in FeO or MnO. A high temperature zincky slag causes little trouble at the tap-hole, and the high temperature also keeps the crucible in a healthier condition.

The accompanying Table I. shows the analysis of product at various stages during the roasting, sintering, and smelting operations, and is typical of the working of the Huntington-Heberlein process during the early stages of its career at the works.

TABLE I.—ANALYSIS OF PRODUCTS AT VARIOUS STAGES DURING ROASTING, SINTERING, AND SMELTING. [122]

——	Pb.	Ag.	Au.	Cu.	Insol.	SiO_2.	FeO.	MnO.	CaO.	Al_2O_3.	Zn.	ZnO.	Sulphur.				Pb as $PbSO_4$.
													Total.	As sulphide	As sulphate.	As $PbSO_4$.	
	p. cent.	Oz. per ton.	Oz per ton.	p. cent.	p. cent.	p. cent.	p. cent.	p. cent.	p. cent.	p. cent.	p. cent.	p. cent.	p. cent.	p. cent.	p. cent.	p. cent.	p. cent.
Raw concentrates	42·98	22·90	0·010	0·166	21·25	10·80	5·84	6·27	1·60	4·30	11·05	..	13·12	..	..	..	..
Silicious ore to roasters ..	8·49	17·40	0·015	0·110	71·00	57·60	9.32	8·66	1·92	7.70	trace	..	0·35	..	..	..	..
Roasted material to converter	34·97	20·35	0·010	0·160	19·02	11·75	7·57	5·47	6·70	4·40	8·63	10·75	8.45	5·75	2·70	0·96	6.20
Roaster product	28·32	13·12	0·0075	0·150	15·35	10·10	7·38	3·11	6·65	3·15	4·36	5·98	10·20	4·07	6·13	3·50	22·70
Sintered product	35·92	21·70	0·0075	0·140	15·12	12·67	7·38	5·66	6·65	3·80	8·72	10·86	3·94	1·34	2·60	1·68	10·90
Converter flue dust	35·54	20·43	0·01	0·098	17.90	11·15	6·04	3·32	5·46	4·00	7·12	8·87	7·79	4·64	3·15	1·43	9·30
Smelter flue dust	32·10	9·50	0·001	..	26·50	..	8·10	1·80	3·0	2·1	..	..	5·29	4·14	1·15	..	..
Smelter slag	1·73	0·59	..	..	..	26·9	26·2	7·9	16·2	4·5	..	12·5	2·9	..	..	..	..
Smelter bullion	98·80	..	0·044	0·34	0·23*	..	..	..	..	..	·05	..	0·38	..	..	..	..
Copper dross	80·40	31·60	·038	5·52	..	..	..	..	..	..	·86	..	6·24	..	..	..	..
Ironstone	..	..	..	..	3·0	..	8·5	0·50	..	..	..	..	..	..	..	..	..
Limestone	..	..	..	..	2·0	..	..	..	54·0	..	..	..	..	..	..	..	..

* Insol. As Sb., &c.

At a later stage the following may be taken as typical of the smelting:—

		Lb.
Charge:	Huntington-Heberlein sintered concts. ...	2,400
	Sintered Slimes ...	800
	Oxidised ore	300
	Ironstone	700
	Limestone	600
	Returned slag ...	800
	Total	5,600
	Coke	900

		Per ton.
Slag:	SiO_2	26·0 per cent.
	FeO	30·0 ,,
	MnO	6·0 ,,
	CaO	16·0 ,,
	Al_2O_3 ...	5·0 ,,
	ZnO	12·0 ,,
	PbO	1 6 ,,
	Ag	0·8 oz. per ton.

The sintered slimes, or concentrates, did not contain enough sulphur to sever from matter during smelting. The fact has since been made use of to treat an appreciable amount of raw concentrates. At the present time the following may be taken as typical of the furnace work* :—

Charge:	Sintered slimes	1,000lb.
	Converted concentrates ..	2,000lb.
	Raw concentrates	200lb.
	Old slag	800lb.
	Ironstone	1,050lb.
	Limestone	550lb.
	Total	5,600lb.
	Coke	840lb.

The charge carries about 17 per cent. of lead. The recovery is about 95 per cent. of lead, 98 per cent. of silver, and practically all the gold.

Slag:	SiO_2	25 per cent.
	FeO	33 ,,
	MnO	6 ,,
	CaO	12 ,,
	ZnO	13 ,,
	Al_2O_3	6 ,,
	S	3 ,,
	Pb	1.5 ,,

The above slag is similar to former slags, except that the CaO has been decreased by about 3 to 4 per cent., and the FeO plus MnO increased by about the same amount, making it more suitable to carry the large amount of ZnO present.

The operation of blowing in a blast furnace at Port Pirie is so timed that it is ready for the blast to be put on early in the day shift. On the previous day shift, or earlier, all the jackets and tuyeres are replaced, and the air and water connections made, with the exception that the tapping-jackets

* Delprat, Trans. Aust. I.M.E., vol. xii., page 19.

at both ends are for the present omitted, and a tuyere sleeve at each end is attached to a 3in. galvanised tube to be used in supplying a forced draught of air to the wood fire in the crucible, which is kept going during the afternoon shift, so as to thoroughly heat the crucible. If the crucible has been freshly built in, a small wood fire is maintained for a day or two to dry it before it is strongly heated ready for blowing in. During the night shift a strong wood fire is maintained, and at the same time 500 to 600 bars of smelter bullion are melted down into the crucible. The wood ashes are raked out from time to time, and a final and complete raking out takes place at the close of the shift. As much firewood as possible is then fed in through the space for the tapping-jackets, which are then built in and attached to the water service, and the separating bowls and spouts fixed in position. While the heating of the crucible and running down of the bullion has been proceeding, blowing-in charges have been weighed out and stacked closely round the mouth of the furnace on the feed floor, so that the shaft may be filled with as little delay as possible. The requisite amount of coke is weighed, bagged, and placed on its respective charge. The following charge may be taken as typical of blowing-in a large furnace:—

Firewood	about ½ ton.	
Coke	3,200 lb.	
Slag	2,000 lb.	20 charges, with 3 bars to each charge.
Coke	670 ,,	
Slag	2,000 lb.	20 charges, with 3 bars bullion to each charge until bullion (about 100 bars) is finished.
H.-H. Mixture...	1,200 ,,	
Kaolin ore	1,000 ,,	
Ironstone	800 ,,	
Limestone	600 ,,	
Coke	670 ,,	

As soon as the tapping-jackets are placed in position the extra firewood is thrown down, followed by a large charge of coke alone, then by 20 slag charges, each with three (sometimes five) bars of bullion with each charge. This is followed by about 20 easy-smelting ore-cum-slag charges, each with extra bullion bars, until the supply of bullion is finished. The regular ore charges are then commenced and continued. The object of the bullion added to the slag and early ore charges is to give a stream of hot lead into the crucible to restore and increase the temperature of the molten bullion, which has been losing heat since the running down was completed. By the time the tapping-jackets have been built in, connected to water connections, &c., spouts placed in position, and the rest of the wood thrown in, molten slag from another furnace is poured on it to light the firewood, and the shaft charged to a considerable height. A gentle blast is now allowed in through the tuyeres, and is progressively increased as the charge of wood and coke is fully alight and as the column of charge is raised. The furnaces require very careful handling for several shifts until they settle down into normal work. Great care is exercised only to draw off lead from the lead wells when it is showing in the tap holes at the ends. If much lead is early drawn off it may cause the whole column of charge to slip down the smooth side of the furnace, and to then force out a further and undue amount of lead bullion. The partly fused bottom of the charge will then be forced down below the fusion zone, and remain as an exceedingly troublesome crust over the crucible, resulting in greatly decreasing the working capacity of the furnace. When there are spare furnaces it is sometimes better to blow in another and then blow out the sick furnace.

Incrustaions form on the side of the furnace and have to be removed from time to time. The usual proceedure is as follows:—The furnace is fed down on slag charges until the top of the charge is down to the jackets. The furnace is drained as dry as possible of liquid slag and the wind then taken off. A large charge of coke is then fed in, and on the top of this is usually placed scrap iron. The incrustation is barred and worked off by means of long bars, further coke and scrap iron being added from time to time as the barrings accumulate in the bottom of the furnace. When the incrustation is removed, or as much as the accumulated barrings will allow, the furnace is filled up and restarted. If the furnace was badly incrusted, it may be necessary to run it down a second time as soon as the barrings have been smelted out. The slag produced at such time is foul, so it is saved, to be returned as the slag constituent of the charges.

When blowing out, the furnace is fed down with slag charges—*i.e.*, charges of slag and coke are added, and at the same time the height of the charge column is allowed to lower and the blast reduced. During the latter part of the lowering of the surface of the charge the feeding openings are covered over and water played on to the floor plates to keep them from becoming too hot. The column is lowered as far as possible, the slag drained out and the blast taken off, the tapping-jackets removed, a hole cut down through the charge and crust into the crucible, and as much lead as possible dipped out. The end jackets are then removed, and as much as possible of the remaining charge raked out. The rest is watered, allowed to cool, and then removed by gads.

At the Cockle Creek works the practice is briefly as follows:—Besides smelting lead concentrates from Broken Hill these works do a large customs business in ore and concentrates of gold, silver, and lead. Their practice is consequently more elastic to suit the conditions, and not so sharply defined as at Port Pirie. The roasting of the Huntington-Heberlein mixture is done in Godfrey revolving hearth furnaces. The roasted mixture is converted in large conical pots. The sintered mixture is smelted in a furnace 120in. by 50in., at the tuyeres, and 36ft. from tapping to feed floor. The blast is supplied by a large electrically-driven positive blower, at a pressure of about 60oz. The furnace is provided with a central uptake flue, as in the Port Pirie furnaces—the latter, however, having been installed owing to the very successful working of the Cockle Creek furnaces. The bullion is tapped into pots, taken to and poured into a drossing furnace, from which the bullion is run out into moulds in a circular moulding machine. The bars while still molten are skimmed, and when solidified are tipped out, sampled, and shipped to Europe for further treatment. The dross from the drossing furnace is returned to the blast furnace. The slag is run out into large pots holding about four tons. The pots are poured by rotating them by gearing. The skulls left in the pots are used for returned slag on the charge.