that the normal concentration of the stock solution is 1½ per cent. in hyposulphite; that 5lb. of copper-sulphate is needed per ton of ore. The 8 cubic feet of stock solution would represent only 7½lb. of hyposulphite: hence not less than 3¾lb. of sodium-hyposulphite should be added to each 5lb. of copper-sulphate in 8 cubic feet of solution in order to produce a normal extra solution. Off the 11¼lb. sodium-hyposulphite now contained in 8 cubic feet of solution 5lb. will be destroyed by the copper-sulphate, leaving 6¼lb. intact. After precipitating the extra solution an ordinary solution of 1¼ per cent. concentration would result. As there is, however, a considerable gain in hypophosphite from the sodium-sulphide the solution will be much stronger than 1¼ per cent., and will probably exceed the original stock solution in concentration. In case the extra solution is preceded by ordinary solution, which is always done in treating roasting ore without caustic lime, and sometimes in treating raw ore, it can be made in the lixiviation-vat itself, on the top of the ore, by stopping the leaching as soon as the liquid has sunk to the surface of the ore. The copper-sulphate is now dissolved, if necessary, with the addition of hyposulphite, and under the same precautions as stated before, by filling the space above the ore about 12in. deep with solution. As this volume is not sufficient to saturate the total amount of ore in the vat the extra solution has to be made in several charges in succession. This method, in the cases specified, is always used and recommended by Mr. Russell. The extra solution is, in most cases, used to best advantage at a temperature of from 90° to 100° Farenheit. If circulated by the Korting injector it is more or less heated thereby.

"*The Sodium-carbonate Solution.*—If pure soda, manufactured by the ammonia process, has been bought this solution does not require purification. It is made by dissolving the soda in hyposulphite stock solution in preference to water, so that in precipitating the lead the concentration of the stock solution in hyposulphite is not diminished. It is recommended to dissolve on each cubic foot of stock solution from 12lb. to 16lb. of soda directly in the storage-tank. In case ordinary soda-ash is at hand it must be purified with copper-sulphate. In this case it is imperative to dissolve soda-ash and hyposulphite-solution. If copper-sulphate solution is carefully added whilst stirring until a black precipitate ceases to appear generally not more than 1lb. of copper-sulphate is consumed to purify 100lb. of soda-ash. The clear solution is drawn into the storage-tanks. Caustic soda is also removed from the solution by copper-sulphate.

"*Sodium-sulphide Solution.*—In order to attain a sodium-sulphide of maximum precipitating-power, the following *modus operandi* should be strictly followed: The whole contents of a drum of caustic soda, 600lb. to 700lb., are broken up into lumps, which should not exceed 5lb. or 6lb. in weight, and which are placed into the iron tank previously described. About 3 to 3¾ cubic feet of water are added, provided dry steam of high pressure is supplied; but less water is used if the steam is not dry and of low pressure. Steam is now turned on, and the tank covered to avoid the spattering of the lye. The dissolving of the caustic soda takes from two to three hours, and at the end of the operation sufficient steam should be admitted to raise the temperature of the lye to not less than 200° Fahrenheit. The condensed steam increases the volume of solution. Its total volume should finally be such that it measures as many cubic feet as there were pounds of caustic soda charged divided by 62½. In other words, one cubic foot of lye should hold 62½lb. of caustic soda. Now pulverized sulphur two-thirds of the weight of the caustic soda is added, a shovelful at the time under stirring. The temperature of the mass rises; it boils and foams, swelling to several times its original volume, while the chemical reaction takes place. If the process is conducted according to the directions given above the sulphur will dissolve rapidly and completely. Should the lye have been either much less concentrated or of lower temperature than previously stated the solution of sulphur will not be complete. In this case the lye has to be boiled with steam for three or four hours. The precipitating coefficient of the finished product is, however, thereby diminished. The sodium-sulphide solution thus obtained is so concentrated that it should solidify upon cooling. It is diluted with hyposulphite stock solution in preference to water, and then transferred to the storage-tanks. The dilution is carried to such an extent that the total volume of the solution measures as many cubic feet as there has been pounds of caustic soda divided by eight.

"The silver precipitating coefficients for caustic soda and sulphur vary according to the proportion of these reagents, and therefore influenced by other circumstances. The highest precipitating coefficient obtainable for caustic soda is 2·3, and for sulphur 4—that is to say, 1 part of caustic soda or sulphur will precipitate 2·3 and 4 parts of silver respectively.

"*Manipulation.—General Rules for Handling the Lixiviation Solutions.*—Before entering into a detailed description of the modifications in lixiviation necessary in special cases, it is best to establish general rules that must be followed under all circumstances, and without which the best results and the greatest economy cannot be reached. The first step to be taken is to ascertain the weight of the ore per cubic foot and the amount of solution required for 1 ton of the ore. From these figures the number of tons of the charge in the lixiviation-vats and the number of cubic feet of solution necessary for saturating the ore are calculated. One cubic foot of dry ore (these ores are generally oxidized, and without any large percentage of sulphurets) weighs from 75lb. to 100lb., and the weight of 1 cubic foot of dry roasted ore is from 55lb. to 90lb. It takes from 7 to 9 cubic feet of solution to saturate 1 ton of raw ore and from 8 to 10 cubic feet for roasted ore.

"All roasted ores are first treated with water, called the first wash-water. Whether the first wash-water is followed by ordinary or by extra solution, it is imperative, at the end of this operation, to stop the discharge of the liquor as soon as the water has sunk to the surface of the ore. The space above the surface of the ore is now filled with solution, and leaching is commenced and continued until a quantity of solution, sufficient to saturate the charge, has been supplied. Now the discharge of the liquid is turned into the precipitating-tank. At the end of leaching with hyposulphite the second wash-water follows the lixiviation solution. Here, again, leaching is stopped as soon as the solutions sink to the surface of the ore. A quantity of water is now turned on sufficient to saturate the charge, and as soon as the liquor sinks to the surface of the ore discharging into the precipitating- tank is stopped, and the wash-water is allowed to run to waste, or it is left in the