attendant will be necessary to see that the solution is not too acid or too alkaline after precipitation.

The further drying of the precipitates preliminary to the distillation of the sulfur must be effected by steam coils or by a special type of drying furnace in which there would be no danger of overheating, with attendant loss of sulfur.

In the distillation operations, it was found that the sulfur began to distil rapidly at 180° C. and from that temperature up to 450° C., the boiling point of sulfur, the rate of distillation would depend upon the rapidity with which the vapors were removed from the retort as well as the temperature.

In all cases, whether the precipitate consisted of $2\text{BaS}_2\text{O}_3 + \text{S}$ or whether a considerable proportion of the precipitate $2\text{BaSO}_3 + 3\text{S}$ was also present, the sulfur was completely distilled at 450° C. The distilled and condensed sulfur was practically pure. The residual product from the distillation was barium sulfite and sulfate.

In the reduction of the barium sulfite or sulfate, by mixing the residue with carbon, coke or coal and heating to a temperature between 750 and 1200° C., there was some tendency for the formation of small amounts of the oxides and carbonates of barium. When the reduced material was used as a precipitate these reacted very slowly with the SO_2 in the dilute solutions from the absorption towers. Therefore, they became "inert" substance, diluting the active BaS, and increasing in amount in each cycle of operations.

If the reduction was effected in a direct fired furnace where the products of combustion passed over the material, the proportion of these inert compounds was greater than if the reduction was brought about by carbon of high purity, quickly, at a high temperature, and in a furnace externally heated.

The use of a coal containing a high percentage of ash also adds "inert" substances to the reduced material in each cycle, and therefore as pure carbon as possible is desirable as reducing agent.

The oxide or carbonate can be connected to the sulfite by agitation with a strong sulfur dioxide solution, or to the sulfate by treatment with sulfuric acid. When reductions are effected in a direct fired furnace, probably 10 per cent of the material would have to be treated with strong sulfur dioxide solution or sulfuric

acid in each cycle to keep the barium as sulfite in sulfate to be reduced again to the sulfide.

If coal, high in ash, is used as reducing agent, and the amount of insoluble matter increases to a certain amount, it will be necessary to leach the entire amount of reduced material, getting the BaS into reduction and discarding the insoluble material.

With the addition of these supplementary operations, it is believed that the technical operation of the process can be carried out successfully for the recovery of sulfur from sulfur dioxide in waste smelter gases. The indications are that, at least in some localities, the process can be applied on a commercial scale which will allow the production of sulfur at a cost of about \$12 per ton.

WEIGHING BURETTE FOR LIQUIDS

By W. ED. BURKHARD

Received July 9, 1917

The weighing burette illustrated below has been found very valuable.

The capacity which determines the diameter of the burette is governed by the material to be analyzed.

The cup *A* is used to prevent fuming while weighing, etc. *B* is made preferably for oleum or other material that would cause spattering. In case of "oleum over 20 per cent" the water into which the acid is to be run has a layer of neutral fine Glauber's salt crystals. By keeping the tip of *B* in the crystals all spattering is avoided. The attachment is left in the solution while titrating.

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ADDRESSES

THE VAPOR PRESSURE AND VOLATILITY OF SEVERAL HIGH-BOILING METALS—A REVIEW¹

By JOHN JOHNSTON

Received July 19, 1917

The question as to the vapor pressure of a metal at a given temperature—or its boiling point at a particular pressure—often arises, as a knowledge of this property is valuable in connection with a number of problems. But the somewhat scanty data to be found in the literature refer, for any one metal, to a small

¹ Presented at the Symposium on the Chemistry and Metallurgy of Zinc, 54th Meeting American Chemical Society, Kansas City, April 10 to 14, 1917.

number of pressures, and in many cases, to a single vapor pressure only—that of one atmosphere; therefore in order to ascertain the vapor pressure at any particular temperature one must in general plot the curve and extrapolate. This procedure takes time and trouble and is moreover not feasible when only one point on the curve has been determined by experiment; more can be learned, as we shall see, by plotting at one time the available data for all the metals hitherto investigated, for by so doing we can set up equations which enable us to calculate the vapor pressure at any temperature with as much certainty as is inherent in the experimental results. On account of the greatly increased availability and usefulness of the data as