

UNITED STATES PATENT OFFICE.

EDWARD HOIT NUTTER, OF SAN FRANCISCO, AND JOHN W. LITTLEFORD, OF ALAMEDA, CALIFORNIA, ASSIGNORS TO MINERALS SEPARATION NORTH AMERICAN CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF MARYLAND.

CONCENTRATION OF SULPHUR.

No Drawing. Application filed April 20, 1928. Serial No. 271,643.

This invention relates to the concentration of sulphur, from its ores, and is herein disclosed as applied to the obtaining of a highly purified sulphur from ores found in Wyoming.

Sulphur containing much more than 2% of gangue fails to meet the requirements of the commercial markets. It has been hitherto found possible to concentrate the sulphur in these and other ores to obtain a concentrate containing upwards of 75% of sulphur, but the products hitherto obtained have been found unmarketable, because when a higher sulphur content than 75% in the concentrate was sought the loss of sulphur in the tailings was so great as to make the process commercially unworkable at a profit.

According to the present invention the sulphur is made more amenable to separation from its gangue by heating the material to cause particles of sulphur to unite, or by sintering or liquating it before effecting a final concentration by froth-flotation procedure. This heating may be preliminary to the final concentraton, or preliminary to the initial or rougher concentration, or may precede both. Some sulphur ores are adapted to yield a sulphur-bearing froth by agitation of the ground sulphur ore in an aqueous pulp, but in the following examples a mineral-frothing agent was used.

Other features and advantages will hereinafter appear in connection with the following examples.

Example 1.—Ohio placer ore, from Wyoming was ground to pass ten-mesh, and heated in a retort for thirty minutes at 35 pounds pressure of steam, in the presence of steam and water. The resulting material formed a cake when cool, and was ground for thirty minutes in a pebble mill. The ground material was made into a pulp with water and agitated in a spitzkasten subaeration froth-flotation machine with 0.4 pounds per ton of a ten per cent solution of pine oil in alcohol while froth was separated for seven minutes, yielding a rougher concentrate. This concentrate was re-agitated in the same ma-

chine for five minutes with added water and with 0.2 pounds per ton of the same solution and separated into a finished froth concentrate and a middling. The results are shown in the following table:

	Assays		Recoveries
	% Wt.	S. %	S. %
Heads	100.	56.2	
Conc.	42.6	96.9	73.4
Midd.	10.8	80.5	15.4
Tails	46.6	13.5	11.2

Example 2.—Yellowstone ore from near Cody, Wyoming was sintered under the same conditions, reground and subjected to similar treatment with the exception that there was used additional pine oil solution to make 0.3 pounds of solution per ton in the second agitation and that the second agitation was continued for six minutes. The results are shown in the following table:

	Assays		Recoveries
	% Wt.	S. %	S. %
Heads	100.	38.4	
Conc.	32.5	98.0	82.9
Midd.	4.9	71.5	9.1
Tails	62.6	5.	8.0

Example 3.—Another lot of the Ohio placer ore, ground to pass 10-mesh was sintered in a retort for 60 minutes at forty pounds steam pressure. The resulting material was ground in a pebble mill and made into a pulp with water and agitated for ten minutes in the same machine with the addition of 0.1 pound of pine oil per ton of ore. The resulting concentrates were sintered in the same way, reground and refloatated by agitation in a pulp in the same machine with the addition of 0.1 pound per ton of pine oil for seven minutes, to yield a second or finished

concentrate, and a middling. The results are shown in the following table:

5		Assays	Recoveries
		S. %	S. %
	Heads.....	54.9	86.2
	Conc.....	98.5	10.6
10	Midd.....	46.8	3.2
	Tails.....	4.5	

Example 4.—A sample of Nevada sulphur ore was ground to pass 80-mesh, made into a pulp with water and agitated in the same machine for six minutes with 0.1 pound per ton of steam distilled pine oil to yield a rougher concentrate.

This concentrate was separated by agitation without added agents into a retreated concentrate and a middling, containing respectively 78.12% and 22.2% sulphur.

This concentrate was melted under a steam pressure of 35 pounds to the square inch, broken down to about quarter-inch size and washed on a ten-mesh screen. The oversize contained 92% sulphur and was suitable for some uses. For the present purpose it was combined with the undersize and the whole ground to pass one-hundred mesh. An aqueous pulp of this ground material was agitated for five minutes with 0.1 pound steam distilled pine oil per ton, to yield a concentrate and a tailing. This latter concentrate was again agitated, without added agents, for five minutes, to yield a finished froth concentrate and a middling. The results are shown in the following table:

40		Assays		Recoveries
		% Wt.	S. %	S. %
	Heads.....	100.	30.	
	Fin. Conc.....	24.6	98.7	78.9
45	Midd. (Final).....	10.7	30.7	10.5
	Midd. (First).....	11.4	22.2	8.2
	Tails.....	53.3	1.4	2.4

Having thus described certain embodiments of our invention, what we claim is:

1. The process of concentrating sulphur-containing material which consists in heating the same to cause particles of sulphur to unite, grinding it to size suitable for froth-flotation concentration, agitating an aqueous pulp of the ground material so as to produce a sulphur-bearing froth, and separating the froth.

2. The process of concentrating sulphur-containing material which consists in heating the same with steam to cause particles of sulphur to unite, grinding the resulting material to a size suitable for froth-flotation concentration, agitating an aqueous pulp of the ground material with a small quantity of a mineral-frothing agent so as to produce a sulphur-bearing froth, and separating the froth.

3. The process of concentrating sulphur-containing material which consists in grinding the material, heating the material to cause particles of sulphur to unite, grinding the resulting material to a size suitable for froth-flotation concentration agitating an aqueous pulp of the ground material so as to produce a sulphur-bearing froth, and separating the froth.

4. The process of concentrating sulphur-containing material which consists in grinding the material, heating the ground material with steam to cause particles of sulphur to unite, grinding the resulting material to a size suitable for froth-flotation concentration, agitating an aqueous pulp of the ground material so as to produce a sulphur-bearing froth, separating the froth, sintering the froth concentrate with steam, grinding the sintered concentrates to a size suitable for froth-flotation concentration, agitating an aqueous pulp of the ground material so as to produce a sulphur-bearing froth, and separating the froth.

In testimony whereof, we have affixed our signatures to this specification.

EDWARD HOIT NUTTER.
JOHN W. LITTLEFORD.