To all whom it may concern:

Be it known that I, ROWLAND THOMAS DRYLL WILLIAMS, a subject of the King of England, residing at Broken Hill, New South Wales, Australia, have invented certain new and useful Improvements in the Separation of Mixed Sulfid Ores, of which the following is a specification.

This invention is for improvements in or relating to the separation of sulfid ores by flotation and it relates more especially to the fractional or differential flotation of certain sulfids from other sulfids.

The object of the invention is to provide a method of treatment of mixed sulfid ores by which differential or fractional products may be obtained therefrom of the various metallic sulfids by flotation separation.

The present invention relates to improvements in flotation separation and more especially to the agitation-froth process of the general type described in the United States patents to Sulman Picard and Ballot. No. 835120 granted November 6th, 1906, to H. L. Sulman No. 955012 granted April 12th, 1910, to Greenway Sulman and Higgins No. 962678 granted June 28th, 1910, to Greenway and Lavers No. 1064729 granted June 17th, 1913, and to H. H. Greenway No. 1099669 granted June 9th, 1914, in which the ore is subjected to agitation and (or) aeration in water in the presence of a frothing agent to produce a scum or froth of metallic sulfids.

Further, the invention is a development of that described in the United States Patent No. 1067485 to Nutter and Lavers granted July 15th, 1913, that is to say, a separation is effected between the different metallic sulfides in the agitation-froth process by varying the controlling conditions, and particularly the chemical constitution of the solution employed. This invention is applicable to other methods of flotation separation, such as that known as film flotation and the like.

I have discovered that by the addition to the circuit liquor or to the water in which the ore is suspended of bleaching powder with or without a persulfate such as ammonium persulfate a differential or preferential flotation separation of certain sulfids (such as galena) from other sulfids (such as blende) may be obtained.

I will now give some illustrations of the application of this invention to certain mixed sulfid ores, though it will be understood that I do not confine myself to these conditions.

A sample of 158 lbs. of a Broken Hill slimes was subjected to agitation and aeration in water to which 16 ozs. of bleaching powder and 6 ozs. of ammonium persulfate were added. When thoroughly agitated one oz. of eucalyptus oil was added, and a further amount of one oz. of the oil was again added during the operation. Float concentrates were removed at intervals which were found to be relatively rich in lead and silver and low in zinc. The residues were found to be relatively low in silver and lead.

A sample of 2 lbs. of Broken Hill slimes assaying Pb. 19.5%, Zn. 24.4% was subjected to agitation and aeration in water to which an amount of bleaching powder had been added equivalent to 25 lbs. per ton and an amount of ammonium persulfate equivalent to 25 lbs. per ton (without the addition of any other frothing agent) when float concentrates were obtained assaying Pb. 50.3% and Zn. 14.2%.

Another sample of 150 lbs. of Broken Hill slimes assaying Pb. 10.2%, Zn. 16% and Ag. 7.1 ozs. was subjected to agitation and aeration in water to which an amount of bleaching powder equivalent to 17.5 lbs. per ton of ore treated was added and an amount of eucalyptus oil equivalent to 4 ozs. per ton of ore treated when float concentrates were obtained assaying Pb. 52.6%, Zn. 15.4%, Ag. 36 ozs. per ton.

Another sample of 3 lbs. of Broken Hill slimes assaying Pb. 19.5%, Zn. 20.4% was subjected to agitation and aeration in water to which was added an amount of iron ammonium alum equivalent to 10 lbs. per ton of ore treated and bleaching powder equivalent to 7 lbs. per ton of ore treated (without the addition of any other frothing agent) when float concentrates were obtained assaying Pb. 55%, Zn. 14% and Ag. 49.2 ozs. per ton giving a recovery of 84.9% Pb.

Another sample of 150 lbs. of Broken Hill slimes assaying Pb. 10.2%, Zn. 16% and Ag. 7.1 ozs. was subjected to agitation and aeration in water to which was added an amount of bleaching powder equivalent to 17.5 lbs. per ton of ore treated and an amount of iron-ammonium-alum equivalent...
to 3.5 lbs. per ton of ore treated and an amount of eucalyptus oil equivalent to 4 ozs. per ton of ore treated when float concentrates were obtained assaying Pb, 59.8%, Zn, 15% and Ag, 88 ozs. per ton, giving a recovery of 64.7% of lead.

What I claim as my invention and desire to secure by Letters Patent is:

1. A process for the separation of mixed metalliferous minerals which consists in mixing an ore containing mixed metalliferous minerals in a finely ground condition with water containing bleaching powder in solution and submitting it to froth flotation separation, whereby products are obtained relatively high in certain values and other products are obtained relatively high in other values.

2. A process for the separation of mixed metalliferous minerals which consists in mixing an ore containing mixed metalliferous minerals in finely ground condition with water containing bleaching powder in solution, agitating the mixture to form a froth, and separating the froth, whereby a product relatively high in certain values is obtained in the froth and a product relatively high in other values is obtained in the residues.

3. A process for the separation of mixed metalliferous minerals which consists in mixing an ore containing mixed metalliferous minerals in a finely ground condition with water containing in solution bleaching powder and a small proportion of a frothing agent, agitating the mixture to form a froth, and separating the froth, whereby a product relatively high in certain values is obtained in the froth and a product relatively high in other values is obtained in the residues.

4. A process for the separation of mixed metalliferous minerals which consists in mixing an ore containing mixed metalliferous minerals in a finely ground condition with water containing in solution bleaching powder and a persulfate, and submitting it to flotation separation, whereby products are obtained relatively high in certain values and other products are obtained relatively high in other values.

5. A process for the separation of mixed metalliferous minerals which consists in mixing an ore containing mixed metalliferous minerals in a finely ground condition with water containing in solution bleaching powder and a persulfate, agitating the mixture to form a froth, and separating the froth, whereby a product relatively high in certain values is obtained in the froth and a product relatively high in other values is obtained in the froth and a product relatively high in other values is obtained in the residues.

6. A process for the separation of mixed metalliferous minerals which consists in mixing an ore containing mixed metalliferous minerals in a finely ground condition with water containing in solution bleaching powder and a persulfate and containing a small quantity of a frothing agent, agitating the mixture to form a froth, and separating the froth, whereby a product relatively high in certain values is obtained in the froth and a product relatively high in other values is obtained in the residues.

7. A process for the separation of zinc and lead which consists in mixing a zinc-lead ore in finely ground condition with water containing bleaching powder in solution and submitting it to flotation separation, whereby a flotation product is obtained relatively high in lead particles and residues are obtained relatively high in zinc particles.

8. A process for the separation of zinc and lead which consists in mixing a zinc-lead ore in finely ground condition with water containing bleaching powder in solution, agitating the mixture to form a froth, and separating the froth, whereby a product relatively high in lead is obtained in the froth and a product relatively high in zinc is obtained in the residues.

9. A process for the separation of zinc and lead which consists in mixing a zinc-lead ore in finely ground condition with water containing bleaching powder in solution and containing a small quantity of a frothing agent, agitating the mixture to form a froth, and separating the froth, whereby a product relatively high in lead is obtained in the froth and a product relatively high in zinc is obtained in the residues.

10. A process for the separation of zinc and lead which consists in mixing a zinc-lead ore in finely ground condition with water containing in solution bleaching powder and ammonium persulfate, thereafter adding a small quantity of a frothing agent, and further agitating the mixture to form a froth, and separating the froth, whereby a product relatively high in lead is obtained in the froth and a product relatively high in zinc is obtained in the residues.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ROWLAND THOMAS DRYLL WILLIAMS.
Witnesses:
ARTHUR GORE COLLISON,
LESLIE HERBERT BROADBENT.