B. S. SMITH.

APPARATUS FOR THE WET DRESSING OF SULFID ORES.

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1,014,977. Patented Jan. 16, 1912.

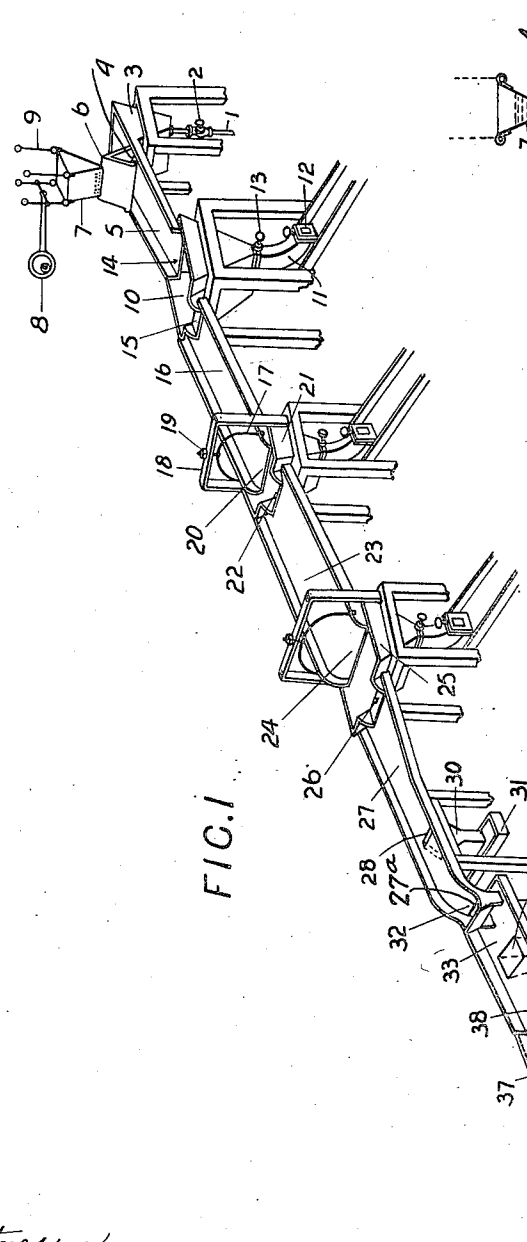

FIG. 1.

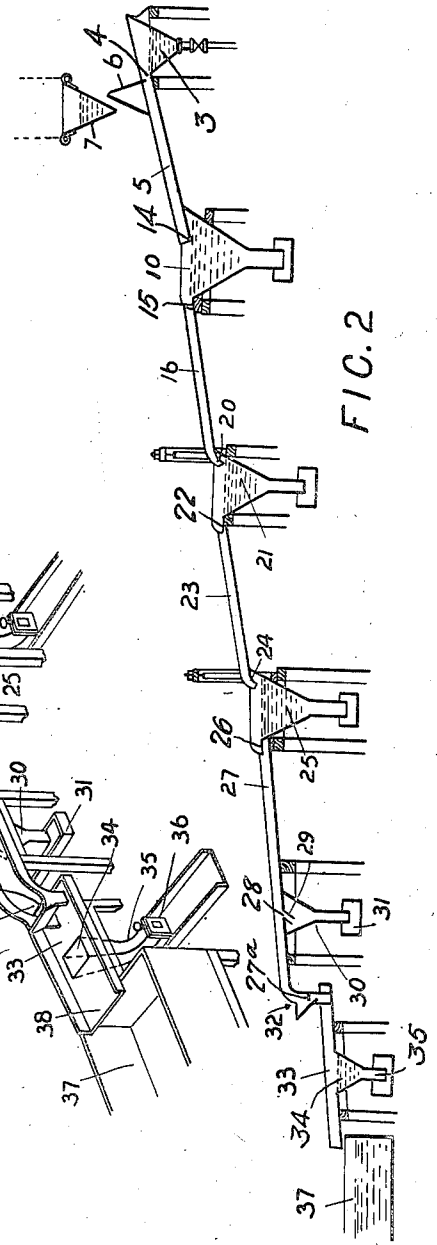

FIG. 2.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR THE WET DRESSING OF SULFID ORES.

1,014,977. Specification of Letters Patent. Patented Jan. 16, 1912.

Application filed August 28, 1911. Serial No. 646,339.

To all whom it may concern:

Be it known that I, BENJAMIN SEDGELY SMITH, subject of the King of Great Britain and Ireland, residing at "Rubinor," Belgrave street, Manly, near Sydney, in the State of New South Wales, Australia, have invented certain new and useful Improvements in Apparatus for the Wet Dressing of Sulfid Ores, of which the following is a specification.

My invention relates to the wet dressing of ores containing sulfids of lead, sliver, and copper, or sulfids of any of those metals, for the purpose of effecting concentration and classification of the same, and it consists in a certain method of treatment and apparatus therefor in which advantage is taken of the fact that a large proportion of the valuable part of finely divided sulfid ore is floatable on a stream of water while other portions thereof averaging much less value sink in the stream and are carried on thereby at a velocity dependent upon their gravity and size having regard to the angle of the table or trough in which the treatment is effected and the velocity of the water flow over the same.

It has been found in practice that representative ores containing lead and zinc sulfids are graded and concentrated in this apparatus. The several products obtained being classified more or less regularly according to size, the separate products may be severally treated separately on re-concentrating tables which are known to act effectively for the separation of mineralized material from gangue when the feed thereto is classified and the table adjusted to suit the particular gage of products passing over it. The products obtained in the first box of the series are coarse and contain a minimum proportion of the values; the products from the intermediate boxes, successively in order, are of diminishing size and progressively richer in values; the produce obtained through the slotted draw-off near the bottom of the lowest trough or table is very fine material containing practically none of the values. The extremely fine products as well as some coarse products are collected in the well in the receiving table at the lower end of the series; they contain a high proportion of fine mineralized matter. The product collected in the settling tank is not always of sufficient richness to pay for collection and treatment. The percentage of values in the settling boxes and in the material which passes through the slot in the lowest trough is found to be lower than the percentage of values in the raw ore, while the material collected in the well in the final table is very high in values.

The invention includes the treatment of ore stuffs on apparatus of the kind described when instead of clear water a solution of an inert substance is added to water for the purpose of increasing its specific gravity or for the purpose of increasing its surface tension, or when there is added to the water any reagent which reacts on the mineralized particles to produce gas bubbles about the same thereby to augment the ordinary water flotation effect.

In order to obtain the best results, the ore should be powdered no finer than is necessary to liberate the values from the gangue. Excessive grinding tends to coat the gangue particles with sulfid dust and to cause the same to become mechanically attached, whereby the gangue is endowed with flotation qualities and is thus rendered more liable to be carried forward with the water flow and become mixed with the collected concentrate.

In the annexed drawings Figure 1 is a perspective elevational view of an apparatus according to my invention, and Fig. 2 a corresponding diagrammatic longitudinal section of the same.

1 is the water feed pipe controllable by a valve 8 and delivering water into a well 3, across the lip 4 of which the water flows in an even unagitated stream over the bottom of the inclined trough or table 5.

6 is a distributing slide to facilitate the easy entry of the ore particles on to the surface of the water flowing over the table 5, and 7 is a shaking box of any convenient form vibrated by an eccentric 8 or similar mechanical appliance, and operating to deliver the ore in a uniformly regular film across the width of the distributers 6 in the table 5. The box 7 may be conveniently hung pivotally from four supports such as 9. Any other mechanical device may be used instead of the ore feed appliance indicated by the figures of reference 6, 7, 8, and 9, so long as that device operates to deliver the ore regularly and gently on to

the surface of the water flowing over the table 5.

10 is a settling box having a boot 11 fitted with a discharge gate 12. There may be an intermediate valve or slide gate in this boot at the place marked 13 to facilitate removal of collected solid matter through the gate 12 without disturbing the water in the box. The lower end 14 of the table 5 dips into the water contained in the box 10. The water which is passed over the table 5 and through the box 10 is delivered over the lip 15 of said box on to the top end of the table 16, the mechanical arrangement being such that the sill 15 is as nearly as possible flush with the surface of the table 16 so that the water will not cascade in passing over the sill. The table 16, and the similar tables later in the series, are preferably made of progressively increasing width toward the lower end. The lower end of this table 16 is supported by a yoke 17 hung up to a bridge carrier 18 by means of a nut and screw 19, or by any similar convenient appliance. Within a limited range, adjustment of the nut 19 enables the angle of the table 16 to be set precisely and the velocity of the liquid and solid mass passing over it regulated to a corresponding limited extent, whereby the behavior of the pulp is controlled as required. The lower end 20 of the table 16 dips into the water contained in the settling box 21, the construction of which is identical with that of the settling box 10, and the sill 22 of this settling box 21 is constructed and arranged like the sill 15 of the settling box 10 in relation to the third table 23, which like the table 16 is made of progressively increasing width toward its lip 24. The lower end of the table 23 is hung up for adjustment purposes precisely in the same manner as the lower end of the table 16. The settling box 25 is constructed similarly to the settling boxes 21 and 10, and the lip 24 of the table 23 dips into the water contained in this settling box. The sill 26, like the sills 22 and 15, is flush with the next succeeding table 27, the width of which is diminished toward its lower end as shown. Near the lower end the bed or floor of the trough or table 27 has a narrow slot 28 cut across it, this slot leading preferably into a slotted mouth 29 as shown in Fig. 2, depending into a chute 30 from which the product passing down through it is delivered to a launder 31.

32 is a drowning box consisting of a well into which the lower end of the table 27 runs, preferably made with a baffle plate 27ª around and under which all the flow must pass before reaching the points of exit at the lower side whence the water and pulp fall on to the foot table 33. This table 33 is set almost horizontally, and about its middle part has formed in it a well 34 terminating in a boot 35 fitted at the foot with a gate 36 similarly to the collecting boxes 25, 21, and 10.

37 is a settling trough of large dimensions receiving the overflow from the lip 38 of the table 33 and discharging its surplus water at the distant end.

In practice it is found that ore fed on to this apparatus is classified, and is also concentrated, the concentrated values being obtained in the well 34. In the collecting box 10 is found the coarsest gangue and a limited quantity of coarse mineralized particles; in the box 21 a finer gage is found carrying a higher proportion of mineralized particles; in the box 25 the proportion of mineralized particles is again higher and the gage finer. A very fine product practically without values is obtained from the launder 31, while the product obtained in the collecting box 34 and in the settling tank 37 is fine mineral, that in the box 34 being considerably richer proportionately in values than the original ore. The settlings in the trough 37 are usually poorer in values than the original ore. The several products obtained in these several boxes, launder, and tank are separately treated on vibrating or pulsating concentrating tables or belts of known type which effectively separate mineralized particles from gangue when the feed is classified as these particular products are found to be.

The apparatus will obviously require to be set for every particular ore in order to effect the most efficient treatment thereof; such setting is however, a manipulation which may be intrusted to a competent observant operator. It is not essential that the troughs or tables 16, 23, or 27 should be of progressively increasing widths, although a distinct advantage is found when they are so made. As shown in Fig. 2, the lips 20 and 24 are set downward angularly; this feature is subject to alteration as in certain cases it may be desirable that the bottom faces of the tables be kept straight so that there will be no tendency of the passing stream of water to cascade into the settling boxes 21 and 25. The beds of the several tables are finished perfectly flat so that wave motions will not be produced in the water passing over them, and each table and settling box is fenced along either side to retain the water and pulp flow thereon.

The rate of feed of the water, controllable by the valve 2, will affect, as will also the rate of feed through box 7, the result of the treatment of ore stuffs on this apparatus. The feed should not be so heavy as to immerse on the first table 5 any of the ore particles which have a natural tendency to float, and the water feed must be sufficient at least to maintain flowing over all the tables a film not less than about one eighth

of an inch in depth; a greater depth is not required, while near the foot of the apparatus, a thinner film of water will produce better results.

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

1. In an apparatus for concentrating and classifying sulfid ores, a trough, inclined to the horizontal, included lateral walls converging toward the lower ends thereof and provided with a slot extending crosswise the bed thereof, an inclined table, provided with a well, arranged below the lower end of said trough, means delivering a film of water upon said trough, mechanism for distributing the ores upon the surface of the film of water, and a drowning box interposed between said trough and said table to conduct the ore carrying film of water from the former to the latter and to thoroughly submerge the ore therein, combined substantially as and for the purposes set forth.

2. In an apparatus for concentrating and classifying sulfid ores, the combination of conducting means for a film of water, means for distributing ores on the surface of the film of water, an inclined table provided with an aperture therein, a valve controlled receptacle open to and in water tight engagement with the said aperture in said table, and a drowning box interposed between said conducting means and said table to conduct the ore carrying film of water from the former to the latter, to thoroughly submerge the ore therein whereby it sinks into said receptacle upon reaching the same.

In testimony whereof I have affixed my signature in presence of two witnesses.

BENJAMIN SEDGELY SMITH.

Witnesses:
W. I. Davis,
M. J. Candrick.