June 12, 1923. 1,458,467

S. H. DOLBEAR

METHOD OF AND APPARATUS FOR CONCENTRATING ORES

Filed Nov. 4, 1919 2 Sheets-Sheet 1

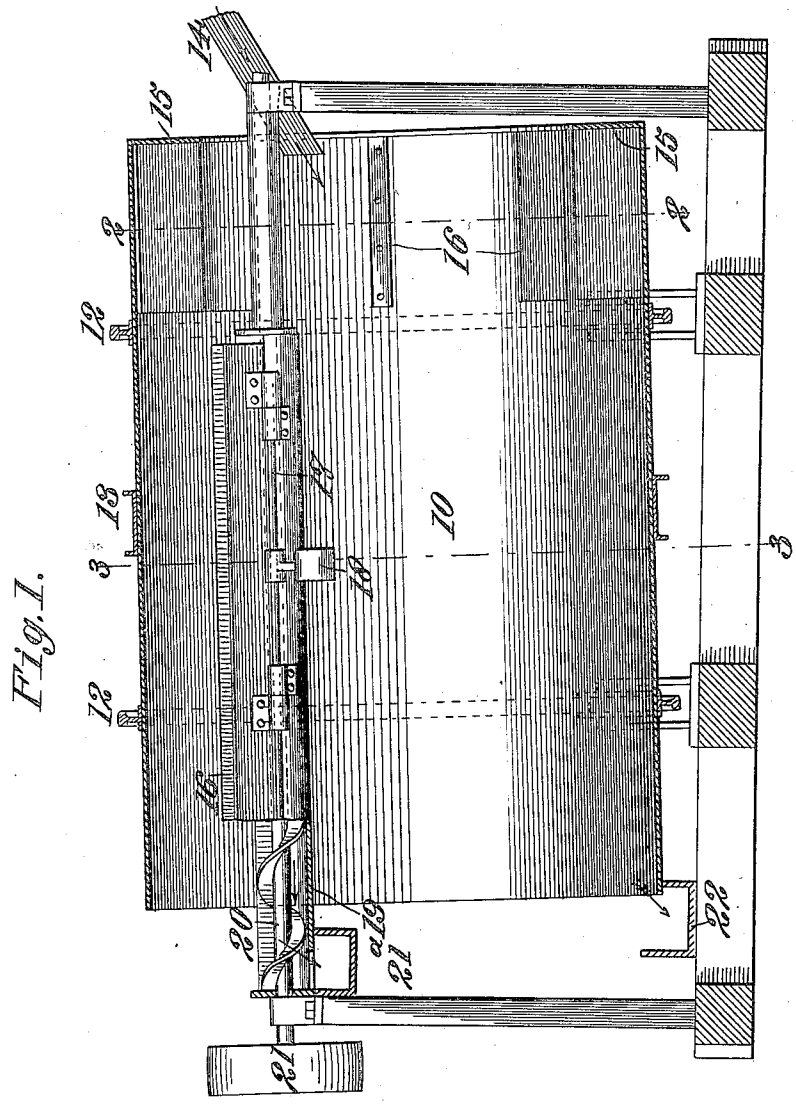


Fig. 1.

INVENTOR
Samuel H. Dolbear

BY Strong & Townsend
ATTORNEYS

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Fig. 2.

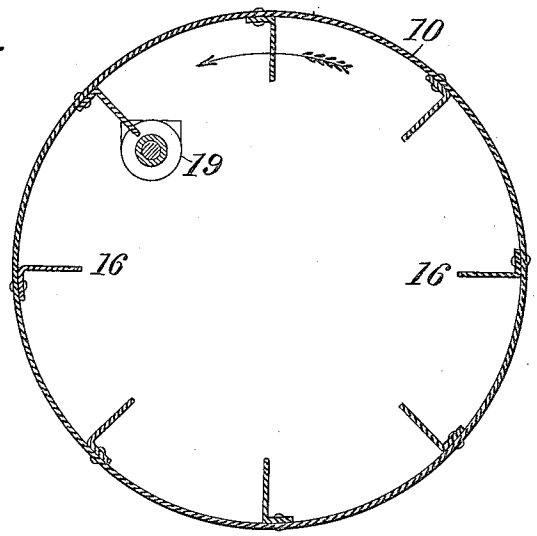
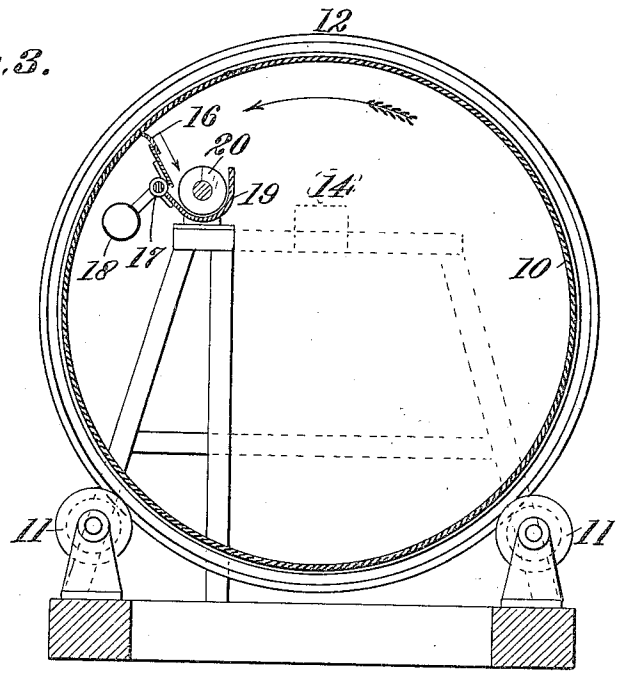


Fig. 3.



INVENTOR
Samuel H. Dolbear

BY Strong & Townsend
ATTORNEYS

Patented June 12, 1923. 1,458,467

UNITED STATES PATENT OFFICE.

SAMUEL H. DOLBEAR, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR OF ONE-HALF TO EDWIN LETTS OLIVER, OF SAN FRANCISCO, CALIFORNIA.

METHOD OF AND APPARATUS FOR CONCENTRATING ORES.

Application filed November 4, 1919. Serial No. 335,664.

To all whom it may concern:

Be it known that SAMUEL H. DOLBEAR, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, has invented new and useful Improvements in Methods of and Apparatus for Concentrating Ores, of which the following is a specification.

This invention relates to a method of and apparatus for concentrating ores, and particularly pertains to a process involving the utilization of the well-known preference of certain substances called selective reagents for metallic and some metalliferous and other substances over gangue.

The object of this invention is to effect economically the concentration and separation of the valuable mineral or metalliferous content of ore, or other materials, from the gangue or other portions that it is desired to reject.

I have discovered that if an ore or other substance containing mineral particles which exhibit a preferential affinity or "wetting" by the selective reagents is mixed with a suitable selective reagent in a medium of suitable liquid, and then brought into contact with a surface or body of metal or a metalliferous substance or any solid surface exhibiting a similar affinity for the so-called selective reagents, the mineral particles present in the pulp adhere to such metallic surface while the waste or gangue exhibits no such phenomena. A concentration is thereby effected and the metalliferous concentrate may then be removed from the sheet of metal and saved.

Briefly, the invention comprehends reducing the ore to the desired degree of fineness, mixing this with water and a small amount of selective reagent, such as oil, circulating this pulp mixture about metallic surfaces, and taking advantage of the fact that there is found to be coherence between such metallic particles and the metallic surface or surfaces.

The accompanying drawings represent one form of an apparatus suitable for practicing the invention:

Fig. 1 being a longitudinal sectional view of same;

Figs. 2 and 3 being cross sections taken on the lines 2—2 and 3—3 respectively of Fig. 2.

In the drawings I show a drum 10, the inner surface of which is constructed of metallic, metalliferous or other solid substance for which a selective reagent exhibits a preferential affinity, and in the following specification I have used the term "collecting element" to designate a surface of this nature. The drum is mounted to revolve on rollers 11 with which tracks 12 on the periphery of the drum engage. The drum is driven at the desired speed by means of a belt passing around a channel ring 13 on the periphery of the drum, and pulp containing a selective reagent such as oil is fed to the interior of the drum through a feed spout 14, and the oil may or may not be mixed with the pulp prior to introducing it into the drum. The pulp is usually treated with a suitable selective reagent before it is introduced in the drum, but such treatment may if desired be carried on within the drum. The latter method may be accomplished by any suitable means for uniformly distributing the oil within the drum. The feed end of the pulp is preferably formed with end flanges 15 to retain the pulp within. Also this end of the drum may be fitted interiorly with baffle-plates 16 by means of which a mixing of the pulp and oil is accomplished in cases where the mixing is not done outside of the drum. The drum is open at its end opposite the feed end and is preferably tilted downwardly towards the discharge end, whereby the pulp will gradually and slowly work its way through the length of the drum and in so doing will be brought into contact with the inside surface of the drum throughout the circumference of the latter, on account of the rotation of the drum. The oil or other selective reagents exhibits a preferential affinity for metallic and metalliferous substances and consequently the mineral particles contained in the pulp will become coated with oil and will, therefore adhere to the drum through which pulp treated with a selective reagent is moving. The mineral particles are removed from the surface of the drum by means of a wiper 16 pivoted on a longitudinal support 17 and pressed against the surface of the drum by means of a counterweight 18. A trough 19 extends longitudinally through the drum and is arranged in position to receive the mineral particles from the wiper. A worm or screw 20 is fitted within the trough 19 and driven by means of a pulley 21 to convey the mineral particles to one end of the trough where

a receptacle 21ª receives them. A sluice or launder 22 is arranged at the discharge end of the drum to receive the gangue or waste.

It will be understood that the kind of material used in the construction of the drum or collecting element, the rate of movement of said collecting element, and the character and percentage of selective reagent used in the pulp should be determined by preliminary tests, since they vary with the nature of the ore being treated. For example, with a drum having a lining of tin and rotated at a speed of 16 R. P. M. into which is introduced Galena ore from the Joplin district, Missouri, containing 10% galena and 90% insoluble and ground to pass a forty mesh screen, and which ore had been treated with one-half of 1% of #100 flotation oil of the Pensacola Tar & Turpentine Co. gave a concentrate adhering to the drum which contained 39% galena, and tails containing less than 1% galena, the extraction being 92.36%. The same drum operating at a speed of 12 R. P. M. on an ore from the Joplin district, Missouri, containing 10% sphalerite and 90% insolubles, ground to pass a forty mesh screen and treated with one-half of 1% flotation oil of the character above mentioned resulted in a concentrate containing 48.37% sphalerite and tails containing about 1% sphalerite, the extraction being 91.9%. In both tests mentioned in the foregoing the drum was allowed to revolve under the charge for 1½ minutes.

With a drum having an inner surface of zinc and rotated at 30 R. P. M., a charge of sphalerite ore from the Joplin district, Missouri, containing 10% of sphalerite and 90% insolubles and ground to pass a forty mesh screen, said ore being treated with one-half of 1% of #609 flotation oil of the Barrett Company of New York, the results showed a concentrate containing 35% sphalerite and tails containing 2% sphalerite, with an extraction of 84.72%.

This process possesses advantages over what is known as the flotation process, some of which advantages are as follows:

The concentrate recovered by this process is substantially dry and does not require the use of thickening or dewatering devices.

No problems of maintaining a froth-constant are involved.

The ore to be treated need be crushed to only that fineness necessary to free mineral particles from the gangue. In most cases it has been found by experiment that ores crushed to pass a forty mesh screen may be concentrated by this method and in some cases a much coarser product has been used with success. In flotation it is generally necessary to pulverize the ore to 150 mesh or finer.

A further advantage lies in the ability of this process to act without classification of the crushed product.

The amount of selective reagent consumed is small, one-half of one per cent or less being usually sufficient.

It is manifest that the shape, design and character of the apparatus employed may vary and that various forms of apparatus may be employed suitable for practicising the invention.

The term "mineral particles" as used in the following claims designates the mineral, metallic or metalliferous content of substances, which content is recoverable by treatment under this process.

By the term "selective reagent" in the claims is meant oil or any non-metal substance that exerts a selective action on metallic substances such as oil exerts.

The term "relatively free from selective reagent," as herein used, refers to the amount of oil present on the surface upon which the oil-particles are retained as compared to the amounts of oil present on surfaces such as are employed in carrying out the invention disclosed in United States Patent No. 899,149 of J. D. Wolf and, also, in other similar processes in which oil or other selective reagent is mechanically spread upon the surface of a belt or similar instrumentality. As hereinabove set forth, the process herein disclosed contemplates the employement of only sufficient oil to coat the mineral particles and cause them to adhere to a surface exhibiting a preference for oil or other selective reagent. I am familiar with the amalgamation of gold and other metals by the use of quicksilver; hence, I disclaim quicksilver as a type of selective reagent to be utilized in practicing my invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A method of separating from gangue or waste those mineral particles which exhibit a preferential wetting by selective reagents, consisting of treating a suitable pulp containing such mineral particles with a selective reagent, bringing the pulp so treated into contact with a solid collecting element which exhibits a preference for selective reagents, and maintaining the portion of the element presented to the pulp relatively free from the selective reagent.

2. A method of concentrating ore by employing the preference of a selective reagent for mineral particles to cause such particles in a finely divided state to adhere to a solid element in and of itself exhibiting a preference for such selective reagent, and maintaining a portion of the solid element relatively free from the selective reagent.

3. A method of separating from gangue or waste those mineral particles which exhibit

a preferential wetting by selective reagents, consisting of treating a suitable pulp containing such mineral particles with selective reagents, bringing the pulp so treated into contact with the surface of a metal also exhibiting a preference for selective reagents, thereby causing the mineral particles to adhere thereto, and maintaining the portion of the element presented to the pulp relative'y free from the selective reagent.

4. A method of separating from gangue or waste those mineral particles which exhibit a preferential wetting by selective reagents, consisting of treating a suitable pu'p containing such mineral particles with a selective reagent, bringing the pulp treated into contact with the surface of a metal-collecting element, removing from such collecting element the mineral particles adhering thereto, and maintaining the portion of the collecting element presented to the pulp relative'y free from the selective reagent.

5. A method of separating from gangue or waste those mineral particles which exhibit a preferential affinity for selective reagents, consisting of treating a suitable pulp containing such mineral particles with a selective reagent, bring the pulp so treated into contact with a moving metallic collecting element which in and of itself exhibits a preference for the selective reagents, and maintaining the portion of the element presented to the pulp relatively free from the selective reagent.

6. A method of separating from gangue or waste those mineral particles which exhibit a preferential wetting by selective reagents, consisting of treating a suitable pulp containing such mineral particles with a selective reagent, bringing the pulp so treated into contact with a metallic collecting element having a rotary movement and which in and of itself exhibits a preference for the selective reagents, and maintaining the surface of the element relatively free from the reagent.

7. A method of separating from gangue or waste those mineral particles which exhibit a preferential wetting by selective reagents, consisting of treating a suitable pulp containing such mineral particles with a selective reagent, bringing the pulp so treated into contact with the metallic surface of a revolving drum and which surface in and of itself exhibits a preference for selective reagents, and maintaining said surface relatively free from the reagent.

8. A method of separating from gangue or waste those mineral particles which exhibit a preferential wetting by selective reagents, consisting of treating a suitab'e pulp containing such mineral particles with a selective reagent, bringing the pulp so treated into contact with an inner metallic surface of a revolving drum exhibiting, in and of itself, a preference for selective reagents, and maintaining such surface relatively free from the reagent.

9. An apparatus for separating mineral particles from gangue, comprising a metallic surface, exhibiting a preferential affinity for selective reagents, with which pulp containing mineral particles is brought into contact, means for maintaining the portion of the contacting surface to which pulp is presented relatively free from the selective reagent and means for removing the mineral particles adhering to such metallic surface.

10. An apparatus for separating mineral particles from gangue, comprising a revolving metallic surface which exhibits a preference for selective reagents, with which pulp containing mineral particles also preferentially wetted by a selective reagent is brought into contact, means for maintaining the portion of the contacting surface to which pulp is presented relatively free from the selective reagent and means for removing particles adhering to such surface.

11. An apparatus for separating mineral particles from gangue, comprising a surface of a solid exhibiting a preferential affinity for selective reagents, means for bringing pulp treated with a selective reagent into contact therewith, and means for maintaining said solid element relatively free from the selective reagent and means for recovering from such surface the mineral particles adhering thereto.

12. An apparatus for separating mineral particles from gangue, comprising a revolving drum having an inner surface which exhibits a preference for selective reagents, means for introducing pulp containing mineral particles and treated with a selective reagent into the interior of said drum, and maintaining the portion of said inner surface to which pulp is presented relatively free from the selective reagent, and means for removing the mineral particles adhering to the surface of said drum.

13. An apparatus for separating mineral particles from gangue, comprising a revolving drum having an inner surface which exhibits a preference for selective reagents, means for introducing pulp containing mineral particles, treated with a selective reagent, at one end of the drum, said drum being arranged to continuously discharge the gangue at the opposite end, and means for maintaining its interior surfaces relatively free from the selective reagent, and means for removing the mineral particles adhering to the surface of said drum.

14. An apparatus for separating mineral particles from gangue, comprising a revolving drum, means for introducing pulp con-

taining mineral particles to the interior of said drum, means for treating the pulp with a selective reagent, said drum having an inside surface exhibiting a preference for selective reagent, and means for keeping the inside surface of the drum substantially free from the selective reagent.

15. A method of separating from gangue or waste those mineral particles which exhibit a preferential wetting by selective reagents, consisting in treating the waste with an oleaginous selective reagent in quantity sufficient to coat the mineral particles with a film, and bringing the mineral particles so treated into contact with a collecting element which is free from the selective reagent used.

16. A method of separating from gangue or waste those mineral particles which exhibit a preferential wetting by selective reagents, consisting in treating the waste with an oleaginous selective reagent in quantity sufficient to coat the mineral particles with a film, and bringing the mineral particles so treated into contact with a collecting element which is free from the selective reagent used but which has an affinity for the selective reagent used.

17. A method of separating from gangue or waste those mineral particles which exhibit a preferential wetting by selective reagents consisting in treating the waste with an oleaginous selective reagent in quantity not greater than 2% relative to the weight of the ore treated to coat the mineral particles with a film, and bring the mineral particles so treated into contact with a collecting element which is free from the selective reagent used.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

SAMUEL H. DOLBEAR.

Witnesses:
R. B. AYRES,
N. B. ELLERY.