

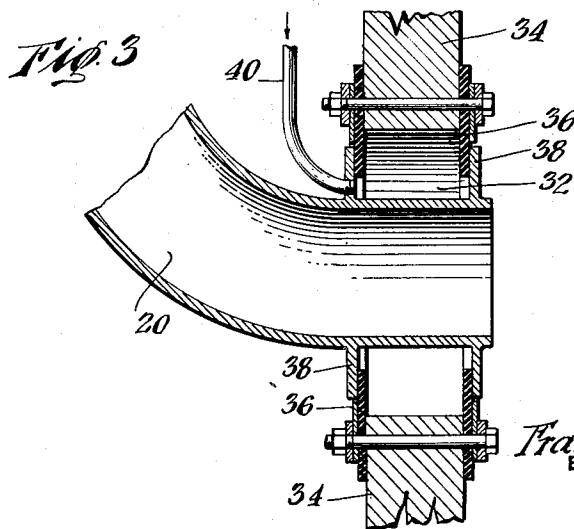
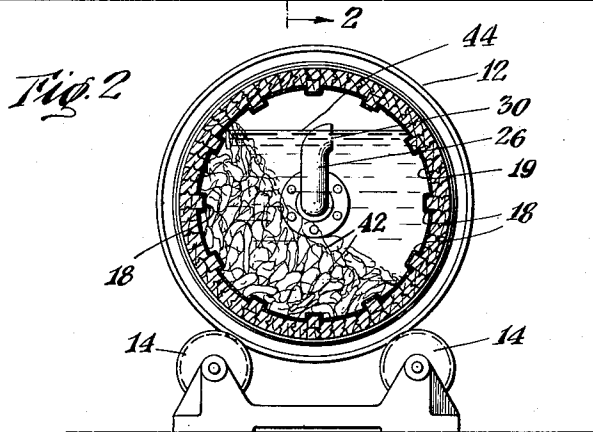
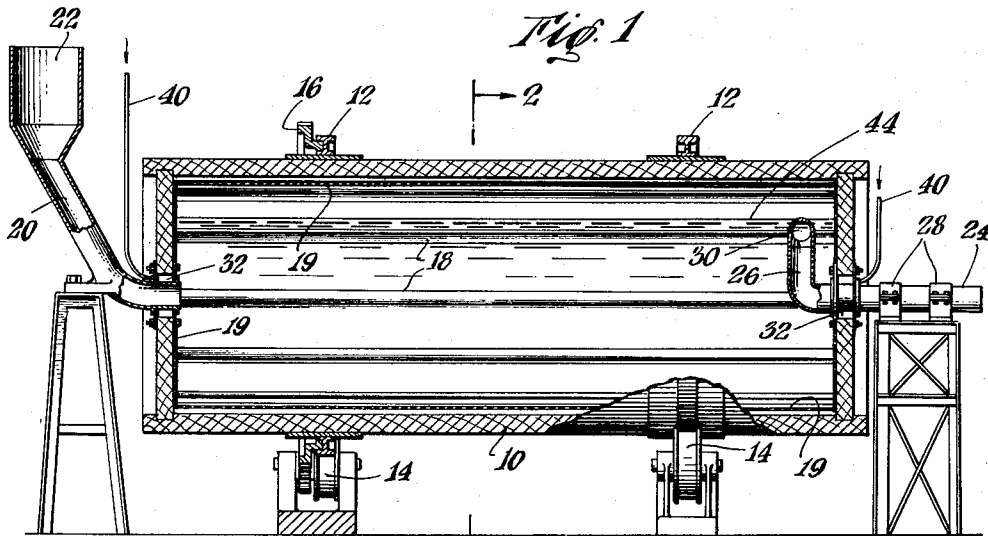
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METHOD OF PRECIPITATING METALS

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METHOD OF PRECIPITATING METALS

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4 Claims. (Cl. 75-109)

My invention relates to an improved method of precipitating metals and is particularly adapted for precipitating copper dissolved in the liquid of finely divided ore pulps.

In the recovery of copper from ores containing both sulfide and acid soluble copper minerals, it has been proposed to dissolve the acid soluble copper and then precipitate the copper in metallic form in the presence of the finely divided solid material of the ore. The pulp containing the sulfide copper, the metallic copper and the gangue is then subjected to flotation to separate the sulfide copper and the metallic copper from the gangue. According to another form of process, the sulfide copper is first floated off. The acid soluble copper remaining in the sulfide flotation tailings is then dissolved and then precipitated in the form of finely divided cement copper amenable to flotation. This copper is then floated off from the tailings in another flotation operation. Problems have arisen in adapting such processes to commercial use, mainly because of difficulties in precipitating the metallic copper efficiently and in a form amenable to flotation.

My method is designed to overcome the difficulties hitherto experienced in this precipitation step.

This method consists in continuously feeding a finely divided ore pulp containing copper in solution, together with iron in suitable form, to a rotating drum. The rate of feed of the iron to the drum is so controlled with relation to the amount of pulp fed to the drum that substantially all of the copper is precipitated and substantially none of the iron is carried out of the drum with the pulp. While iron in a suitable form and state of subdivision may be obtained from various sources, I prefer to use a specially prepared iron made from old tin cans or new tin plate clippings and punchings. This material is prepared in a shredding machine and known as "shredded iron". It will pass through a 1½ inch round opening and as it only weighs about 50 lbs. per cubic foot in comparison with 450 lbs. for solid iron it offers a very large surface of contact with the solution in the drum. The use of this light weight precipitating material has the further advantage of permitting the use of a light weight drum.

The accompanying drawing shows in diagrammatic form the arrangement of a form of precipitation drum that has been found to be particularly suitable in practicing this invention.

In the drawing:

Fig. 1 is a longitudinal sectional side elevation of the drum.

Fig. 2 is a section taken on line 2-2 of Fig. 1.

Fig. 3 is a detail of the sand-proof glands.

Referring to the drawing, the drum 10 is of wood stave construction. The drum is provided with riding rings 12 which rest on the rollers 14 and is driven through the driving gear 16 by any suitable means. Around the periphery and lengthwise of the drum are located rubber covered lifters 18, which not only have the effect of raising the iron charge and intermingling it with the pulp, but also largely prevent the charge from slipping and rubbing against and abrading the inside of the drum. In order further to protect the wooden staves and the end walls against abrasion, I find it advantageous to line the entire interior of the drum with rubber as shown at 19. At the inlet end of the drum is the feed pipe 20 extending upward to the hopper 22 positioned well above the drum. At the outlet end of the drum is the discharge pipe 24 which is provided with a curved extension 26 extending into the interior of the drum. The elevation of the outlet orifice 30 of the extension 26 may be varied by rotating the discharge pipe 24 in its support 28, thus permitting the liquid to be carried at any desired level within the range permitted by the adjustability of the rotatable discharge extension 26. In order to prevent the abrasive pulp from contacting with the friction surfaces, both ends of the drum are equipped with sand-proof glands 32 as shown in Fig. 3. The orifices in the drum ends 34 are provided with rubber rings 36 which contact in movable relation with metal rings 38 attached to the feed and discharge pipes 20 and 24. Water enters the gland 32 through the pipe 40 at sufficient pressure to permit of a small outflow of water against the pulp in the drum.

In operation the pulp containing the copper in solution and the shredded iron are fed together into the hopper 22. The rate of feed is so regulated that the iron load in the drum is kept below the point where it will obstruct the inflowing pulp and iron at the feed end of the drum. For example, when aiming to obtain high capacity, the iron load may be held constant at about half full as indicated in Fig. 2 at 42. The pulp level is usually held at a point well above the top of the iron charge and at or adjacent the level of the discharge orifice as at 44 and may be regulated by changing the height of the discharge orifice 30. The regulation of the rate of feed of the iron and the height of the pulp in the

drum permits the use of substantially the entire volume of the drum and, consequently, insures sufficient time for complete precipitation of the copper from its solution. As illustrated in Figure 2 of the drawing, the discharge orifice 30 is disposed at the pulp level on the side of the pipe extension 26 farthest from the iron load. This arrangement aids in preventing iron from passing out of the drum.

While the capacity of the drum is increased by operating with the pulp level in a high position, it will be understood that because of other considerations it may be desirable to operate with a lower pulp level. Any desired regulation of the level of the pulp is made possible by reason of the adjustability of the discharge pipe forming a feature of my precipitation drum.

Due to the rotation of the precipitation drum and the form of the iron used, the copper is rubbed or abraded off the surface of the iron as soon as it is deposited, thus presenting surfaces of iron of relatively extended area, for further deposition of the copper and also producing a minutely divided copper which is amenable to flotation. Another feature that makes for rapid precipitation of the copper is the fact that the amount of iron present in the drum is very much larger than the amount of copper present in the drum at the same time. In other words, the copper in solution is exposed to many times its weight of iron. This helps to speed up precipitation. In an actual operation the load of iron has approximated about 70 times by weight the amount of copper present in the drum either as cement copper or as dissolved copper.

In carrying on the precipitating operation as hereinbefore described, I have found that in addition to producing finely divided cement copper amenable to flotation, from 5-6% of the copper in solution, is deposited in the precipitating drum by what appears to be crystal growth in the form of copper pellets. These pellets average about $\frac{1}{4}$ inch in diameter and are easily recovered by discontinuing the addition of iron to the drum for several hours to reduce the iron load in the drum and then dumping the entire contents of the drum through a manhole not shown. At intervals of three or four days this material should be discharged. The copper pellets may be separated from the residual shredded iron by magnetic separation.

It will be understood that the method may be applied equally as well in precipitating copper from clear solutions as from ore pulp. Most cement copper produced up until the present time has been precipitated from clear solutions on the surfaces of stationary iron in launders. The precipitated copper must be removed periodically from this iron in order to expose new iron surfaces, as otherwise the precipitation of copper would cease, and at best the process is very slow and the removal of the copper cumbersome and expensive. By comparison, by the use of my method very rapid precipitation is effected because fresh surfaces of iron are being continuously exposed to the solution. It also makes the recovery of this copper a simple matter as it floats out of the drum with the solution and may be recovered by settling or filtration.

It will be understood that various changes may be made in the details of the construction of the apparatus employed and that various of the procedural details may be modified without depart-

ing from the invention which is not to be deemed as limited except as indicated by the appended claims.

I claim:

1. The method of precipitating copper from its solution in the liquid of an ore pulp which comprises continuously passing said ore pulp together with shredded iron through a rotating drum, and maintaining the liquid level in said drum above the center of the drum, and so controlling the rate of feed of the shredded iron in relation to the rate of feed of the pulp that the amount of iron is held at substantially constant volume within the drum.

2. The method of precipitating copper in its solution in the liquid of an ore pulp which comprises establishing a body of said pulp in a rotating drum to a height well above the center line of said drum, continuously passing ore pulp together with shredded iron to said drum beneath the liquid level therein, continuously withdrawing treated pulp admixed with the precipitated copper from said drum at a point remote from the point of introduction of iron and at or adjacent the liquid level in said drum, so controlling the rate of feed of the finely divided iron in relation to the rate of feed of the pulp that the iron is consumed during its residence within the drum and so controlling the rate of feed of the pulp that substantially all of the soluble copper is precipitated from its solution before exiting from said drum.

3. The method of recovering copper from copper-bearing solutions which comprises continuously passing a copper-bearing solution through a rotating drum and contacting it therein with shredded iron, maintaining the liquid level in said drum well above the center of the drum, feeding shredded iron to said zone at a rate sufficient to maintain a charge of iron therein of substantially constant volume and relatively large as compared with the amount of copper present in the drum, agitating the solution and the iron precipitant in said drum, continuously withdrawing the resulting cement copper from said zone in suspension in the spent solution, and preventing discharge of iron from said zone with said spent solution by withdrawing said solution from said zone through an opening disposed at a point removed from the charge of iron in said zone and adjacent the level of the solution therein.

4. The method of precipitating copper from its solution in the liquid of an ore pulp which comprises continuously passing ore pulp through a rotating drum and contacting it therein with shredded iron, maintaining the liquid level in said drum well above the center of the drum, feeding shredded iron to said drum to establish and maintain a charge of iron therein of substantially constant volume and relatively large as compared with the amount of copper present in the drum, continuously withdrawing treated pulp admixed with the precipitated copper from said drum at a point adjacent the liquid level therein, and so controlling the rate of feed of the shredded iron in relation to the rate of feed of the pulp that the iron is consumed during its residence within the drum and so controlling the rate of feed of the pulp that substantially all of the soluble copper is precipitated from its solution before exiting from said drum.

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