(12) STANDARD PATENT (11) Application No. **AU 2014277706 B1**
(19) AUSTRALIAN PATENT OFFICE

(54) Title
Concentrate manufacturing method and concentrate manufacturing system

(51) International Patent Classification(s)
C22B 3/44 (2006.01) ***C22B 34/36*** (2006.01)
B03D 1/02 (2006.01)

(21) Application No: **2014277706** (22) Date of Filing: **2014.08.01**

(43) Publication Date: **2015.02.12**
(43) Publication Journal Date: **2015.02.12**
(44) Accepted Journal Date: **2015.02.12**

(71) Applicant(s)
Japan Oil, Gas and Metals National Corporation

(72) Inventor(s)
Nakamura, Iichi;Takahashi, Tatsuru

(74) Agent / Attorney
Cotters Patent & Trade Mark Attorneys, GPO Box 469, Sydney, NSW, 2001

(56) Related Art
JP 2002-248459
JP 2009-050796
WO 2012/137359

ABSTRACT

The present concentrate manufacturing method comprises a first mixed water generating process for generating first mixed water in which first water and powdery run-of-mines are mixed (S1), a first separating process for separating first floating minerals, first precipitating minerals, and first filtrate water contained in the first mixed water by passing the first mixed water through a first separating part (S2), a second mixed water generating process for generating second mixed water in which second water that is different from the first water and the first precipitating minerals are mixed (S3), and a second separating process for separating second floating minerals, second precipitating minerals, and second filtrate water contained in the second mixed water by passing the second mixed water through a second separating part, wherein the first filtrate water is used as a portion of the first water in the first mixed water generating process, and the second filtrate water is used as a portion of the second water in the second mixed water generating process.

CONCENTRATE MANUFACTURING METHOD AND CONCENTRATE MANUFACTURING SYSTEM

TECHNICAL FIELD

[0001] The present invention relates to a concentrate manufacturing method and a concentrate manufacturing system for manufacturing a concentrate by conducting a flotation.

BACKGROUND OF THE INVENTION

[0002] Conventionally, a method for beneficiating oxides such as tin ore and tungsten ore by conducting a flotation is known. Patent Literature 1 discloses a method for manufacturing a titanium dioxide concentrate from titanium dioxide ore by conducting a flotation. Further, Non-Patent Literature 1 discloses a method for manufacturing a tungsten concentrate from tungsten ore by conducting a flotation.

[0003] FIG. 4 shows a process of a conventional concentrate manufacturing method disclosed in Non-Patent Literature 1. As shown in FIG. 4, when oxides are being beneficiated by conducting a flotation, a first flotation process (a desulfurization flotation process) for removing sulfides contained in ores is performed after the ores are ground by using a ball mill. Next, a tin mineral and a tungsten mineral that are oxides are collected by performing a second flotation process (a tungsten flotation process) for precipitating minerals obtained in the desulfurization flotation process. In the first flotation process, sulfide collectors for floating sulfides are used, and in the second flotation process, oxide collectors for floating oxides are used.

[0004] Patent Literature 1: WO2012/137359

[0005] Non-Patent Literature 1: Kitaru SAWAKI, “The present state of tungsten ore dressing at Fujigatani Mine, Yamaguchi Prefecture.” The Journal of the Nippon Kogyo Kai (Nippon Institute of Mining and Metallurgical Engineers), April 1986, vol. 102, no. 1178, pp.230-233

SUMMARY OF INVENTION

[0006]

[Problems to be solved by the invention]

In a conventional beneficiation method by conducting a flotation, removed sulfides and tailings remaining at the end are sent to a tailing dam and are settled. Overflow collected from the tailing dam after solid materials are precipitated is reused in the flotation process. However, the oxide collectors for floating the oxides remain in the overflow. Accordingly, if the collected overflow is used in the first flotation process for removing the sulfides by conducting a flotation, some parts of oxides float in the first flotation process and are removed. As a result, there is a problem that the recovery rate of oxides decreases. For example, there is a result of a simplified examination showing that the recovery rate is about 44.0% when the overflow collected from the tailing dam is used for 75% of the water used in the first flotation process, although the recovery rate is 59.8% when the overflow is not reused in the first flotation process.

[0007] In order to prevent the above-mentioned problem, a method that does not reuse the collected water in the first flotation process can be considered. However, there is a problem that a lot of fresh water must be used if the collected water is not reused in the first flotation process. When beneficiation is carried out in dry regions, it is necessary to reduce the amount of fresh water to be used because using fresh water increases costs.

[0008] Further, if the collected water is not reused in the first flotation process, a water treatment for removing harmful substances such as fluoride contained in the water remaining in the tailing dam is needed, and a large amount of money is required. In rainy regions, it is necessary to reduce the amount of water remaining in the tailing dam because the amount of water remaining in the tailing dam becomes large.

[0009] Therefore, an object of the present invention is to provide a concentrate manufacturing method and a concentrate manufacturing system that can increase the recovery rate while decreasing the amount of water used in a flotation process.

[0010]

[Means for solving the problems]

A concentrate manufacturing method in the first aspect of the present invention comprises a first mixed water generating process for generating first mixed water in which first water and powdery run-of-mines are mixed, a first separating process for separating the first mixed water into first floating minerals (for example, sulfide flotation floats), first precipitating minerals (for example, sulfide flotation sinks), and first filtrate water contained in the first mixed water, a second mixed water generating process for generating second mixed water in which second water that is different from the first water and the first precipitating minerals are mixed, and a second separating process for separating the second mixed water into second floating minerals (for example, scheelite concentrates), second precipitating minerals (for example, oxide flotation sinks), and second filtrate water contained in the second mixed water, wherein the first filtrate water is used as a portion of the first water in the first mixed water generating process, and the second filtrate water is used as a portion of the second water in the second mixed water generating process.

[0011] The first separating process may include a first floating mineral separating process for separating the first floating minerals and the first filtrate water contained in the first mixed water by passing a portion of the first mixed water through a first floating mineral separating part (for example, a filter 142), and a first precipitating mineral separating process for separating the first precipitating minerals and the first filtrate water contained in the first mixed water by passing another portion of the first mixed water through a first precipitating mineral separating part (for example, a filter 144).

[0012] The second separating process may include a second floating mineral separating process for separating the second floating minerals and the second filtrate water contained in the second mixed water by passing a portion of the second mixed water through a second floating mineral separating part (for example, a filter 262), and a second precipitating mineral separating process for separating the second precipitating minerals and the second filtrate water contained in the second mixed water by passing another portion of the second mixed water through a second precipitating mineral separating part (for example, a filter 234).

[0013] The second floating mineral separating process may include conducting a flotation of minerals containing the second floating minerals in the second mixed water at a first temperature, generating third mixed water in which the minerals containing the second floating minerals and the second filtrate water are mixed at a second temperature higher than the first temperature, and separating the second floating minerals contained in the third mixed water by passing a portion of the third mixed water through the second floating mineral separating part.

[0014] The first separating process may use water in which the first filtrate water and water obtained from outside are mixed as the first water, and the second separating process may use water in which the second filtrate water and water obtained from outside are mixed as the second water.

[0015] Further, the first separating part may generate the first floating minerals by adding first collectors to the first mixed water, and the second separating part may generate the second floating minerals by adding second collectors different from the first collectors to the second mixed water.

[0016] Furthermore, the first separating part may generate the first floating minerals by making the first collectors containing first organic compounds react with sulfides contained in the run-of-mines, and the second separating part may generate the second floating minerals by making the second collectors containing second organic compounds react with oxides contained in the first precipitating minerals.

[0017] The above described concentrate manufacturing method may further comprises dry stacking the second precipitating minerals after removing water contained in the second precipitating minerals. In this case, the concentrate manufacturing method may further include generating solid materials by mixing the first floating minerals with cement or fly ash, and dry stacking on the solid materials.

[0018] A concentrate manufacturing system in the second aspect of the present invention comprises a first separating part configured to separate first mixed water, in which first water and powdery run-of-mines are mixed, into first floating minerals, first precipitating minerals, and first filtrate water, a second separating part configured to separate second mixed water, in which second water that is different from the first water and the first precipitating minerals are mixed, into second floating minerals, second precipitating minerals, and second filtrate water, a first water storing part configured to store the first filtrate water, and a second water storing part configured to store the second filtrate water, wherein the first separating part uses water in the first water storing part as the first water and the second separating part uses water in the second water storing part as the second water.

[0019]

[Effect of the invention]

According to the present invention, the recovery rate can be increased while the amount of water used in a flotation process is decreased.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

FIG. 1 shows a flow of a concentrate manufacturing method according to the present embodiment.

FIG. 2 shows a configuration of a first processing part of a concentrate manufacturing apparatus according to the present embodiment.

FIG. 3 shows a configuration of a second processing part of the concentrate manufacturing apparatus according to the present embodiment.

FIG. 4 shows a process of a conventional concentrate manufacturing method.

DETAILED DESCRIPTION OF THE INVENTION

[0021]

[Outline of a concentrate manufacturing method]

FIG. 1 shows a flow of a concentrate manufacturing method according to the present embodiment. In FIG. 1, solid lines show flows of minerals, and broken lines show flows of water. In the present embodiment, a case of beneficiating a scheelite that is a kind of tungstate mineral from a tungsten ore is described, but the present invention can be applied to cases of beneficiating tin, titanium, and rare earth.

[0022] First, after grinding the tungsten ore into fine powder using a grinding machine such as a ball mill, a first mixed water generating process for generating first slurry a1 is performed by putting the powdery tungsten ore, first water, and first collectors containing first organic compounds into a conditioning tank and stirring them (S1). The first water is water containing fresh water obtained from outside and the undermentioned first filtrate water.

[0023] Next, a first separating process for separating the generated first slurry a1 into first floating minerals (sulfide flotation floats), first precipitating minerals (sulfide flotation sinks), and the first filtrate water is performed (S2). In the first separating process, a sulfide flotation process is performed first (S21). In the sulfide flotation process, air is injected into a flotation processing part where the sulfide flotation process is performed after the first slurry a1 is put into the flotation processing part. As the first collectors, ethyl xanthate can be used, for example. By this means, sulfides contained in the first slurry a1 react with the first collectors and get into a state of floating. Then, components other than the sulfides precipitate to the lower portion of the flotation processing part as first precipitating minerals.

[0024] Next, a filtering process for separating first slurry a2 containing the first precipitating minerals that precipitated to the lower portion of the flotation processing part into the first precipitating minerals and the first filtrate water other than the first precipitating minerals by passing the first slurry a2 through a filter is performed (S22).

[0025] Further, in parallel with step S22, a filtering process for separating first slurry a3 containing the first floating minerals floating in the flotation processing part into the first floating minerals and the first filtrate water other than the first floating minerals by passing the first slurry a3 thorough a filter is performed (S23). The first floating minerals are disposed of because the first floating minerals are sulfides contained in tungsten ore, which are not required to be collected. The details of a method for disposing of the first floating minerals will be described later. The first filtrate water separated in the steps S22 and S23 is reused as a portion of the first water used in the step S1.

[0026] Next, a process for extracting scheelite from the first precipitating minerals is performed because the first precipitating minerals separated in the filtering process of the step S22 contain the scheelite. Here, a second mixed water generating process for generating second slurry b1 is performed first by putting the first precipitating minerals, second water, and second collectors containing second organic compounds into the conditioning tank and by stirring them (S3). The second water is water including the undermentioned second filtrate water and is different from the first water. Further, the second water may contain fresh water obtained from outside.

[0027] Next, a second separating process for separating the generated second slurry b1 into second floating minerals (scheelite concentrates), second precipitating minerals (sulfide floatation tailings), and the second filtrate water (S4). In the second separating process, an oxide flotation process is performed first (S41). In the oxide flotation process, air is injected into the floatation processing part after the second slurry b1 is put into the flotation processing part. As the second collectors, oxide paraffin can be used, for example. By this means, oxides contained in the second slurry b1 react with the second collectors and get into a state of floating. Then, components other than the oxides precipitate to the lower portion of the flotation processing part as the second precipitating minerals.

[0028] Next, a filtering process for separating the second slurry b2 containing the second precipitating minerals that precipitated to the lower portion of the flotation processing part into the second precipitating minerals and the second filtrate water other than the second precipitating minerals by passing the second slurry b2 through a filter is performed (S42). Because the second precipitating minerals are tailings that are not required to be collected, a dry stacking process is performed after removing water (S43). The details of the dry stacking process will be described later.

[0029] Further, in parallel with step S42, a filtering process for separating second slurry b3 containing the second floating minerals floating in the flotation processing part into the second floating minerals and the second filtrate water other than the second floating minerals by passing the second slurry b3 through a filter is performed (S43). The second floating minerals are scheelite concentrates that are expected to be collected. Further, the second filtrate water separated in the steps S42 and S43 is reused as a portion of the second water used in the step S3.

[0030] By the means described above, the scheelite can be obtained from tungsten ore at a high recovery rate. Here, one of the characteristics of the present embodiment is that the first filtrate water is reused as a portion of the first water used in the first mixed water generating process (S1) and the first separating process (S2), and the second filtrate water is reused as a portion of the second water used in the second mixed water generating process (S3) and the second separating process (S4).

[0031] Because the first filtrate water is separated from the first precipitating minerals and the first floating minerals by using a filter, the first filtrate water does not contain the first precipitating minerals and the first floating minerals. Accordingly, the first filtrate water can be reused with fresh water obtained from outside. Further, the second filtrate water is separated from the second precipitating minerals and the second floating minerals by using a filter, the second filtrate water does not contain the second precipitating minerals and the second floating minerals. Accordingly, the second filtrate water can also be reused.

[0032] However, the second filtrate water contains the second collectors containing the second organic compounds for floating oxides during the oxide flotation process. If the second filtrate water containing the second collectors is mixed with the first filtrate water, some of the oxides float together with sulfides in the first separating process, and a portion of the oxides that should be collected are disposed as a portion of sulfide flotation sinks. Therefore, in the present embodiment, the second filtrate water is only reused as the second water used in the second mixed water generating process S3 and the second separating process S4 without being mixed with the first filtrate water.

[0033] Further, in the present embodiment, efficiency of the processing of tailings can be improved by performing the dry stacking process after removing water from the second precipitating minerals that are oxide flotation sinks (S5) because the tailings are not required to be transferred to a distant place. Specifically, the dry stacking process includes the following steps.

[0034] First, prior to the dry stacking process, a solid material is generated by mixing the first floating minerals generated in the first separating process with cement or fly ash. By solidifying the first floating minerals in a strong alkali, the first floating minerals containing sulfides are prevented from reacting with oxygen in air to generate sulfuric acid water that leads to an environmental problem.

[0035] The solidified first floating minerals are used as liners on the underside of dry stacks. Specifically, the generated solid materials are mounted on a dry stacking area for performing the dry stacking process. Then, the dry stacking process is performed by stacking cakes that are made by removing water from the second precipitating minerals on the solid materials placed in the dry stacking area. The cakes stacked on the solid materials generated from the first floating minerals are compacted with a roller or the like to prevent permeation of rain water and to stabilize the deposited materials.

[0036]

[A configuration of a concentrate manufacturing system]

FIG. 2 and FIG. 3 show a configuration of a concentrate manufacturing system for performing the above mentioned concentrate manufacturing method. FIG. 2 shows a configuration of a sulfide flotation apparatus 1 for performing a sulfide flotation process in the concentrate manufacturing system. FIG. 3 shows a configuration of an oxide flotation apparatus 2 for performing an oxide flotation process in the concentrate manufacturing system. Dashed lines in FIG. 2 show flows of the first filtrate water and dashed lines in FIG. 3 show flows of the second filtrate water. Hereinafter, details of the concentrate manufacturing system are described by referring to FIG. 2 and FIG. 3.

[0037] The sulfide flotation apparatus 1 includes a first water tower 11, a grinding part 12, a conditioning tank 13, a first separating part 14, and a first water tank 15. The first water tower 11 has a tank and a water pipe that provides fresh water used in the sulfide flotation apparatus 1. When the first filtrate water provided from the first water tank 15 is insufficient, the first water tower 11 provides fresh water corresponding to the insufficient amount.

[0038] The grinding part 12 is, for example, a ball mill. The grinding part 12 grinds feeds of concentrates that are manufactured by the concentrate manufacturing system to powder.

[0039] The conditioning tank 13 is a tank for generating slurry by mixing the first filtrate water provided from the first water tank 15, run-of-mines powdered in the grinding part 12, and the first collectors containing the first organic compounds. When the water provided from the first water tank 15 is insufficient, fresh water provided from the first water tower 11 may be put into the conditioning tank 13.

[0040] The first separating part 14 separates sulfides, components other than the sulfides, and the first filtrate water by performing the sulfide flotation process. The first separating part 14 includes a flotation processing part 141, a filter 142, a thickner

143, and a filter 144.

[0041] The flotation processing part 141 is a flotation machine for performing the sulfide flotation process. When air is injected into the flotation processing part 141 after the slurry generated in the conditioning tank 13 is put into the flotation processing part 141, sulfides in the slurry that reacted with the first collectors float.

[0042] The filter 142 separates the sulfide flotation floats floating in the slurry from of the slurry in the upper portion of the flotation processing part 141. The filter 142 is, for example, a filter press (a filtering machine that applies pressures) that has a filter cloth having holes smaller than a particle size of the sulfide flotation floats and bigger than a water molecule. The sulfide flotation floats separated in the filter 142 are solidified. The slurry remaining after separating the sulfide flotation floats by the filter 142 is sent to the thickner 143.

[0043] The thickner 143 performs precipitating and thickening process for the slurry in the lower portion of the flotation processing part 141 and liquid sent from the filter 142 to increase the solid concentration of the slurry. The thickner 143, for example, increases the solid concentration of the slurry from 35% to 65%. Overflow (O/F) whose concentration has been increased in the thickner 143 is sent to the first water tank 15. Underflow (U/F) in the thickner 143 is sent to the filter 144.

[0044] The filter 144 separates the precipitating sulfide flotation sinks from the underflow of the thickner 143. The filter 142 is, for example, a filter press that has a filter cloth having holes smaller than a particle size of the sulfide flotation sinks and bigger than a water molecule. The filter 144 may include the same filter cloth as the filter 142. The sulfide flotation sinks separated by the filter 144 are sent to an oxide flotation apparatus 2 because the sulfide flotation sinks contain oxides. Further, the liquid remaining after separating the sulfide flotation sinks by the filter 144 is sent to the first water tank 15.

[0045] The first water tank 15 stores the liquid sent from the thickner 143 and the filter 144 as the first filtrate water. The first water tank 15 supplies only an amount of the stored first filtrate water that is required in the conditioning tank 13. Because the first water tank 15 stores the first filtrate water and the first filtrate water is reused, the amount of extra water drained into a tailing dam can be reduced.

[0046] Next, a configuration of an oxide flotation apparatus 2 is described by referring to FIG. 3. The oxide flotation apparatus 2 includes a second water tower 21, a conditioning tank 22, a second separating part 23, a second water tank 24, a conditioning tank 25, and a third separating part 26.

[0047] The second water tower 21 includes a tank and a water pipe that provides fresh water used in the oxide flotation apparatus 2. When the second filtrate water provided from the second water tank 24 is insufficient, the second water tower 21 provides fresh water corresponding to the insufficient amount.

[0048] The conditioning tank 22 is a tank for generating slurry by mixing the second filtrate water provided from the second water tank 24, the sulfide flotation sinks sent from the sulfide flotation apparatus 1, and the second collectors containing the second organic compounds. When the water provided from the second water tank 24 is insufficient, fresh water provided from the second water tower 21 may be put into the conditioning tank 22.

[0049] The second separating part 23 separates oxides, components other than the oxides, and the second filtrate water by performing the oxide flotation process at a normal temperature. The second separating part 23 includes a flotation processing part 231, a thickner 232, a thickner 233, and a filter 234.

[0050] The flotation processing part 231 is a flotation machine for performing an oxide flotation process. When air is injected into the flotation processing part 231 after the slurry generated in the conditioning tank 22 is put into the flotation processing part 231, oxides in the slurry that reacted with the second collectors float.

[0051] The thickner 232 performs precipitating and thickening process for the slurry containing oxide flotation floats obtained in the flotation processing part 231 to increase the solid concentration of the slurry. The thickner 232, for example, increases the solid concentration of the slurry from 40% to 70%. Underflow whose concentration has been increased in the thickner 232 contains scheelite and is sent to the third water separating part 26 in order to improve the grade of the scheelite. Overflow in the thickner 232 is stored in the second water tank 24 as the second filtrate water.

[0052] The thickner 233 performs precipitating and thickening process for the slurry containing tailings in the flotation processing part 231 and the slurry containing tailings in the undermentioned flotation processing part 261 to increase the solid concentration of the slurry. Overflow of the thickner 233 is stored in the second water tank 24 as the second filtrate water. Further, the slurry that is an underflow of the thickner 233 is sent to the filter 234.

[0053] The filter 234 separates oxide flotation sinks from the underflow of the thickner 233. The filter 234 is, for example, a filter press that has a filter cloth having holes smaller than a particle size of the oxide flotation sinks and bigger than a water molecule. The oxide flotation sinks separated by the filter 234 are dry stacked after the water therein is removed. The water remaining after the filter 234 separates the oxide flotation sinks is stored in the second water tank 24 as the second filtrate water.

[0054] The second water tank 24 stores the liquid sent from the thickner 232, the thickner 233, the filter 234, and a filter 262 as the second filtrate water. The second water tank 24 supplies only a required amount of the stored second filtrate water to the conditioning tank 22 and the conditioning tank 25. Because the second water tank 24 stores the second filtrate water and the second filtrate water is reused, the amount of extra water drained into a tailing dam can be reduced.

[0055] The conditioning tank 25 is a tank for generating slurry by mixing the second filtrate water provided from the second water tank 24, a scheelite flotation float sent from the thickner 232, and the second collectors containing the second organic compounds. When the water provided from the second water tank 24 is insufficient, fresh water provided from the second water tower 21 may be put into the conditioning tank 25.

[0056] The third separating part 26 separates a scheelite concentrate and the second filtrate water by performing the oxide flotation process at a temperature (for example, 65 - 90°C) higher than the temperature of the second separating part 23. The third separating part 26 can extract the scheelite of higher grade because the selectivity of adsorptions of the second organic compounds to the scheelite can be improved by performing the oxide flotation process at the high temperature.

[0057] The third separating part 26 includes the flotation processing part 261 and the filter 262. The flotation processing part 261 is a flotation machine for performing an oxide flotation process. When air is injected into the flotation processing part 261 after putting the heated slurry generated in the conditioning tank 25 into the flotation processing part 261, oxides in the slurry that reacted with the second collectors float.

[0058] The filter 262 separates the scheelite concentrate that is an oxide floating in the flotation processing part 261. The filter 262 is, for example, a filter press that has a filter cloth having holes smaller than a particle size of the scheelite concentrate and bigger than a water molecule. The water remaining after the filter 262 separates the scheelite concentrate is stored in the second water tank 24 as the second filtrate water.

[0059] As described above, in the oxide flotation apparatus 2, the grade of the collected scheelite can be improved by performing the oxide flotation process at a high temperature in the third separating part 26 after collecting a lot of scheelite by performing the oxide flotation process at a normal temperature in the second separating part 23.

[0060]

[Effect of the present embodiment]

According to a concentrate manufacturing system of the present embodiment, the sulfide flotation apparatus 1 that collects sulfides from run-of-mines separates sulfide flotation sinks and first filtrate water through the filter 144. Further, the oxide flotation apparatus 2 that collects oxides separates oxide flotation sinks, a scheelite concentrate, and second filtrate water through the filter 234 and the filter 263. Accordingly, the first filtrate water and the second filtrate water do not contain impurities and can be reused for generating slurry in the conditioning tank 13, the conditioning tank 22, and the conditioning tank 25, and so a lot of extra water can be prevented from being drained into a tailing dam. Also, environmental impact can be reduced in a point that the second filtrate water containing fluorine is not drained.

[0061] Further, the reuse of the first filtrate water and the second filtrate water can decrease the amount of fresh water obtained from outside. Accordingly, the cost of manufacturing concentrates can be reduced in dry regions where the cost of water is high.

[0062] Furthermore, while the water used for the flotation is reused, the second filtrate water containing the second collectors used in the oxide flotation process is not used in the sulfide flotation apparatus 1, and so a situation where some parts of oxides come to float in the sulfide flotation apparatus 1 and are processed as tailings is prevented. Accordingly, the recovery rate of oxides can also be improved.

[0063] Moreover, in the oxide flotation apparatus 2, the oxide flotation process is performed at a high temperature in the third separating part 26 after the oxide flotation process is performed at a normal temperature in the second separating part 23. By this means, a high grade scheelite concentrate can be collected.

[0064] And furthermore, sulfide flotation floats generated in a sulfide flotation process in the sulfide flotation apparatus 1 are solidified and used as liners on the underside of dry stacks, and the oxide flotation sinks generated in the oxide flotation process in the oxide flotation apparatus 2 are dry stacked. By this means, sulfide flotation floats are prevented from reacting with oxygen in air and from generating sulfuric acid water that leads to an environmental problem.

[0065] The present invention is described with the exemplary embodiment but the technical scope of the present invention is not limited to the scope described in the above embodiment. It is apparent for those skilled in the art that it is possible to make various changes and modifications to the embodiment. It is apparent from the description of the scope of the claims that the forms added with such changes and modifications are included in the technical scope of the present invention.

[0066] For example, in the above embodiment, a filter press was shown as examples of the filters 142, 144, 234, and 262, but these filters may be disk filters.

[0067] Further, in the above embodiment, the oxide flotation apparatus 2 includes the second separating part 23 and the third separating part 26, and a case is described in which the flotation process in the second separating part 23 and the flotation process in third separating part 26 are performed at different temperatures, but the embodiment is not limited to the above case. For example, the second separating part 23 may include a filter having a function similar to the filter 262, and a scheelite concentrate may be separated in the second separating part 23.

[0068] Furthermore, in the above embodiments, a configuration of the oxide flotation apparatus 2 that includes the second water tower 21 was shown, but the oxide flotation apparatus 2 need not include the second water tower 21 and the first water tower 11 may provide fresh water to the conditioning tank 22.

[0069]

[Explanations of the reference numerals]

1 Sulfide flotation apparatus

2 Oxide flotation apparatus

11 First water tower

12 Grinding part

13 Conditioning tank

14 First separating part

15 First water tank

21 Second water tower

22 Conditioning tank

23 Second separating part

24 Second water tank

25 Conditioning tank

26 Third separating part

141 Flotation processing part

142 Filter

143 Thickner

144 Filter

231 Flotation processing part

232 Thickner

233 Thickner

234 Filter

261 Flotation processing part

262 Filter

263 Filter

CLAIMS

1. A concentrate manufacturing method comprising:

a first mixed water generating process for generating first mixed water in which first water and powdery run-of-mines are mixed;

a first separating process for separating the first mixed water into first floating minerals, first precipitating minerals, and first filtrate water contained in the first mixed water;

a second mixed water generating process for generating second mixed water in which second water that is different from the first water and the first precipitating minerals are mixed; and

a second separating process for separating the second mixed water into second floating minerals, second precipitating minerals, and second filtrate water contained in the second mixed water, wherein

the first filtrate water is used as a portion of the first water in the first mixed water generating process, and the second filtrate water is used as a portion of the second water in the second mixed water generating process.

2. The concentrate manufacturing method according to Claim 1, wherein

the first separating process includes:

a first floating mineral separating process for separating the first floating minerals and the first filtrate water contained in the first mixed water by passing a portion of the first mixed water through a first floating mineral separating part, and

a first precipitating mineral separating process for separating the first precipitating minerals and the first filtrate water contained in the first mixed water by passing another portion of the first mixed water through a first precipitating mineral separating part, and

the second separating process includes:

a second floating mineral separating process for separating the second floating minerals and the second filtrate water contained in the second mixed water by passing a portion of the second mixed water through a second floating mineral separating part, and

a second precipitating mineral separating process for separating the second precipitating minerals and the second filtrate water contained in the second mixed water by passing another portion of the second mixed water through a second precipitating mineral separating part.

3. The concentrate manufacturing method according to Claim 1 or 2, wherein

the second floating mineral separating process includes:

conducting a flotation of minerals containing the second floating minerals in the second mixed water at a first temperature,

generating third mixed water in which the minerals containing the second floating minerals and the second filtrate water are mixed at a second temperature higher than the first temperature, and

separating the second floating minerals contained in the third mixed water by passing a portion of the third mixed water through the second floating mineral separating part.

4. The concentrate manufacturing method according to any one of Claims 1 to 3, wherein

the first separating process uses water in which the first filtrate water and water obtained from outside are mixed as the first water, and the second separating process uses water in which the second filtrate water and water obtained from outside are mixed as the second water.

5. The concentrate manufacturing method according to any one of Claims 1 to 4, wherein

the first separating part generates the first floating minerals by adding first collectors to the first mixed water, and

the second separating part generates the second floating minerals by adding second collectors different from the first collectors to the second mixed water.

6. The concentrate manufacturing method according to Claim 5, wherein

the first separating part generates the first floating minerals by making the first collectors containing first organic compounds react with sulfides contained in the run-of-mines, and

the second separating part generates the second floating minerals by making the second collectors containing second organic compounds react with oxides contained in the first precipitating minerals.

7. The concentrate manufacturing method according to any one of Claims 1 to 6, further comprising:

dry stacking the second precipitating minerals after removing water contained in the second precipitating minerals.

8. The concentrate manufacturing method according to Claim 7, further comprising:

generating solid materials by mixing the first floating minerals with cement or fly ash; and

dry stacking on the solid materials.

9. A concentrate manufacturing system comprising:

a first separating part configured to separate first mixed water, in which first water and powdery run-of-mines are mixed, into first floating minerals, first precipitating minerals, and first filtrate water;

a second separating part configured to separate second mixed water, in which second water that is different from the first water and the first precipitating minerals are mixed, into second floating minerals, second precipitating minerals, and second filtrate water;

a first water storing part configured to store the first filtrate water; and

a second water storing part configured to store the second filtrate water, wherein

the first separating part uses water in the first water storing part as the first water and the second separating part uses water in the second water storing part as the second water.

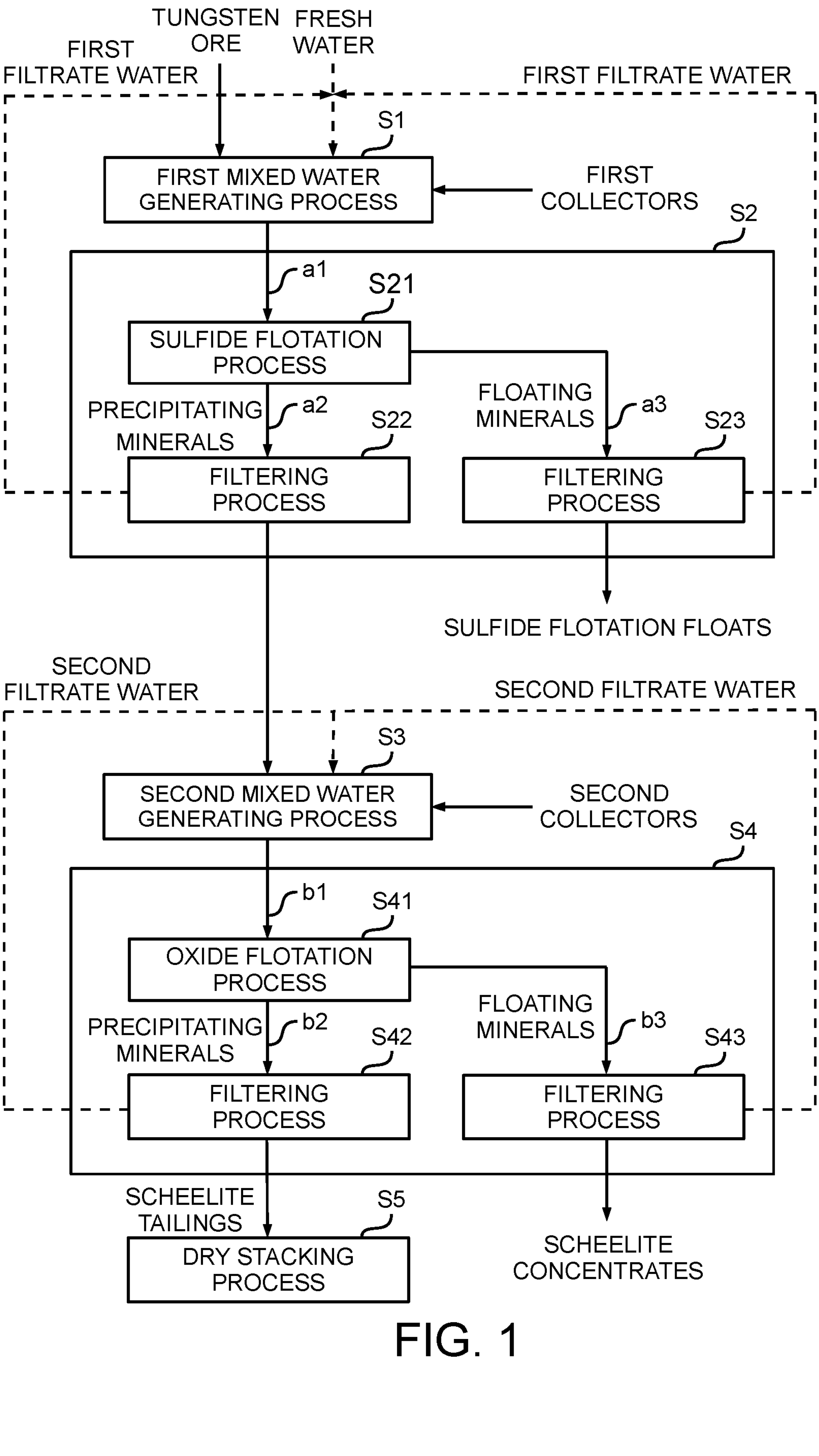
TUNGSTEN ORE
FRESH WATER
FIRST FILTRATE WATER
FIRST FILTRATE WATER
S1
FIRST MIXED WATER GENERATING PROCESS
FIRST COLLECTORS
S2
a1
S21
SULFIDE FLOTATION PROCESS
PRECIPITATING MINERALS
a2
S22
FLOATING MINERALS
a3
S23
FILTERING PROCESS
FILTERING PROCESS
SULFIDE FLOTATION FLOATS
SECOND FILTRATE WATER
SECOND FILTRATE WATER
S3
SECOND MIXED WATER GENERATING PROCESS
SECOND COLLECTORS
S4
b1
S41
OXIDE FLOTATION PROCESS
PRECIPITATING MINERALS
b2
S42
FLOATING MINERALS
b3
S43
FILTERING PROCESS
FILTERING PROCESS
SCHEELITE TAILINGS
S5
DRY STACKING PROCESS
SCHEELITE CONCENTRATES

FIG. 1

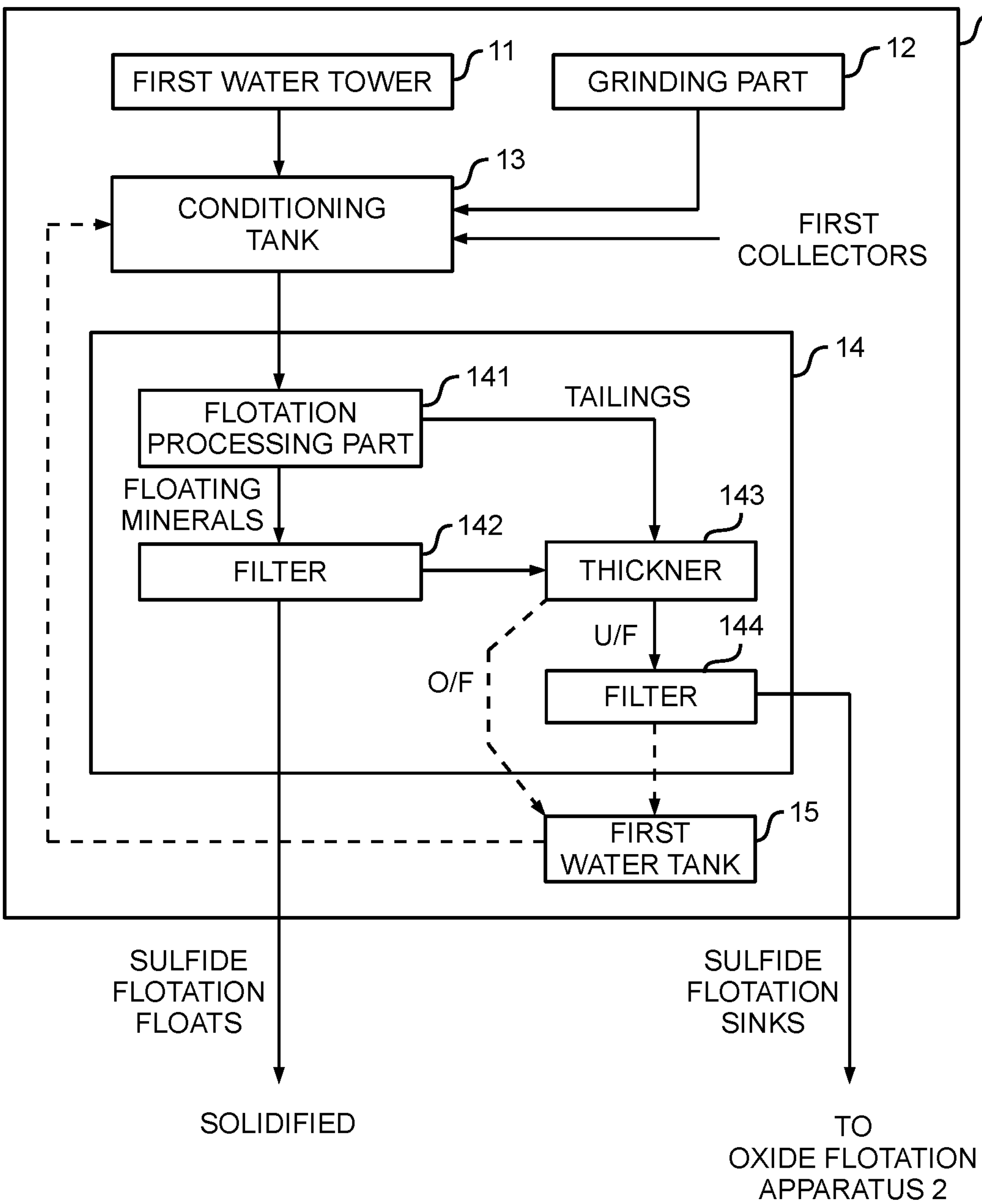
1
FIRST WATER TOWER
11
GRINDING PART
12
CONDITIONING TANK
13
FIRST COLLECTORS
14
FLOTATION PROCESSING PART
141
TAILINGS
FLOATING MINERALS
FILTER
142
THICKNER
143
U/F
144
O/F
FILTER
FIRST WATER TANK
15
SULFIDE FLOTATION FLOATS
SULFIDE FLOTATION SINKS
SOLIDIFIED
TO OXIDE FLOTATION APPARATUS 2

FIG. 2

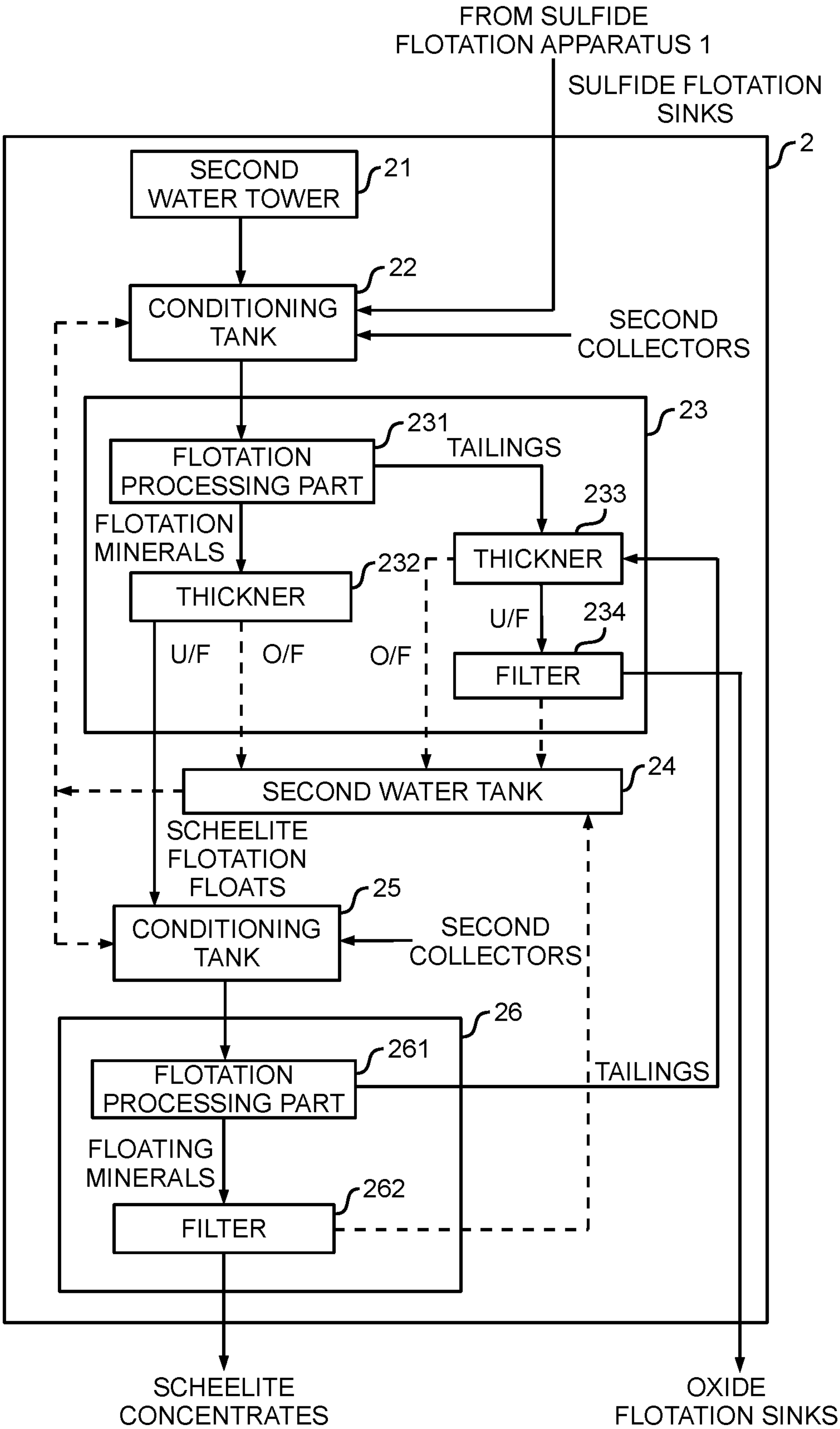
FROM SULFIDE
FLOTATION APPARATUS 1
SULFIDE FLOTATION
SINKS
2
SECOND
WATER TOWER
21
22
CONDITIONING
TANK
SECOND
COLLECTORS
23
231
TAILINGS
FLOTATION
PROCESSING PART
233
FLOTATION
MINERALS
THICKNER
232
THICKNER
U/F
234
U/F
O/F
O/F
FILTER
SECOND WATER TANK
24
SCHEELITE
FLOTATION
FLOATS
25
CONDITIONING
TANK
SECOND
COLLECTORS
26
261
TAILINGS
FLOTATION
PROCESSING PART
FLOATING
MINERALS
262
FILTER
SCHEELITE
CONCENTRATES
OXIDE
FLOTATION SINKS

FIG. 3

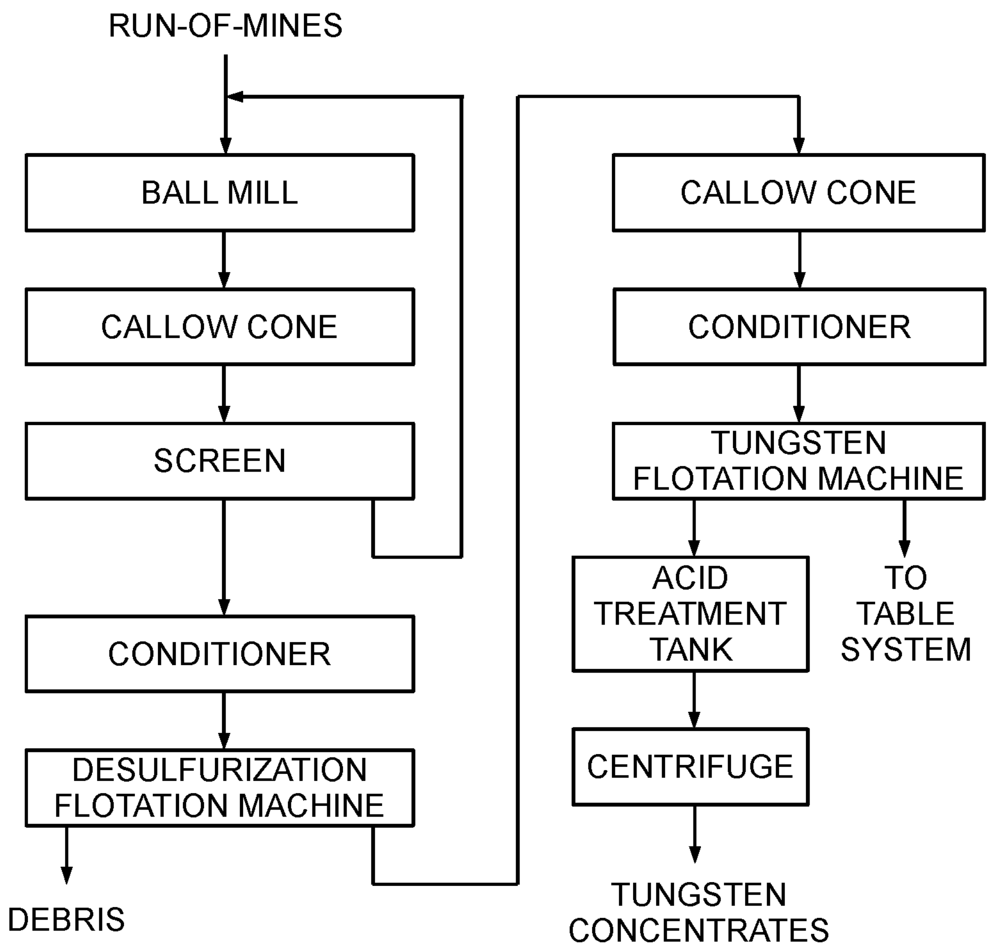
RUN-OF-MINES
BALL MILL
CALLOW CONE
SCREEN
CONDITIONER
DESULFURIZATION FLOTATION MACHINE
DEBRIS
CALLOW CONE
CONDITIONER
TUNGSTEN FLOTATION MACHINE
ACID TREATMENT TANK
TO TABLE SYSTEM
CENTRIFUGE
TUNGSTEN CONCENTRATES

FIG. 4