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FLOTATION SEPARATING PROCESS.

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Our invention relates to a flotation process of refining ores and more particularly to a flotation process of refining ores containing carbonaceous material.

In certain ores, particularly those containing zinc and lead compounds in certain districts, a tarry carbonaceous material occurs which interferes seriously with the separation of the zinc and lead compounds from the gangue, due to the adhesive nature of the tarry carbonaceous material where separation by gravity is made. In order to avoid this difficulty, the adhesive action of the tarry carbonaceous material is cut by means of an oil, preferably a kerosene oil. The gravity separation as is well known leaves a by-product that still contains a large amount of zinc and lead compounds, largely zinc and lead sulphides, that it would be desirable to recover and a flotation process is the most desirable means of recovery of these sulphides. It is, however, very difficult if not entirely impossible to do this by the usual flotation method employed, due to the fact that the kerosene oil in the pulp or the solution of tarry substance in the kerosene oil interferes with the flotation of the zinc and lead compounds in the manner that ordinarily takes place in such a process. It is accordingly a purpose of our invention to provide a flotation separating process for the recovery of zinc and lead compounds from a pulp containing such compounds and carbonaceous substances similar to tar and oils not commonly used in oil flotation processes, by the treatment of the pulp with a reagent that counteracts the undesirable effect of the tarry substances and the undesirable oil such as kerosene oil so as to prevent the interference thereof with the flotation process. The reagent preferably used is oxalic acid.

While the process is particularly adapted for the separation of zinc and lead compounds such as sphalerite and galena from a pulp mixture containing waste rock, water, carbonaceous substances of a tarry nature and oils, such as kerosene, not commonly used in oil flotation processes, obviously the process might be modified to obtain the separation of other valuable minerals from waste material containing the carbonaceous substances and the oil that interferes with the flotation process as ordinarily practiced. While kerosene and a tarry carbonaceous substance are particularly referred to, obviously the process could be utilized where any similar substances interfering with a flotation process are present in the material that is to be subjected to such process to thus prevent the interference of such substances with the process.

Other objects and advantages of the invention will appear as the description proceeds. However, we desire to have it distinctly understood that we do not intend to limit ourselves to the exact details of the method described, but that we intend to include as part of our invention all such obvious changes and modifications thereof as would occur to a person skilled in this art and as would fall within the scope of the claims.

Our improved process comprises the treatment of what is commonly known in the art as a pulp so as to separate the valuable mineral ingredients therein from the undesirable ingredients in said pulp. The pulp is usually a mixture of water, the minerals that are to be recovered, finely ground waste rock of any kind, carbonaceous substances similar to tar or crude oil, and oils which may occur naturally in the ore or which are added before the flotation process is practiced on the pulp during the prior treatment of the ore. In the pulp that it is particularly desirable to treat by our improved process, the minerals are usually zinc and lead sulphides.

To the above described pulp there is first added lime in sufficient quantity to aid in the precipitation of the fine particles of colloidal-like material in the carrying out of our process. The density of the pulp is then permitted to increase by settling until the same is substantially 25% solid matter by weight, although the exact percentage is not essential. After the lime has been added, soda ash is preferably added in sufficient quantity to slightly increase the alkaline reaction of the solution.

Either at the time that the soda ash is added or a short time subsequent thereto, a sufficient quantity of oxalic acid ($H_2C_2O_4$) is added to the pulp to dissolve the carbonaceous material and oil that interfere with the flotation process. The oxalic acid may be added in the crystalline form or in solution

and while the exact quantity may vary in accordance with the amount of tarry carbonaceous substance or undesirable oil present in the pulp, the amount used will be a relatively small proportion of the dry weight of the pulp, it having been unnecessary to add even as much as one per cent by weight of oxalic acid to any of the ores that have been treated in this manner up to the present time. While the oxalic acid is preferably permitted to act on the pulp for a brief period of time before adding the flotation materials thereto, this is not absolutely necessary although desirable, and the length of time the oxalic acid is permitted to act on the pulp may be very short, from three to six minutes having been found desirable.

After the oxalic acid has been added in the manner pointed out above, suitable collecting, sulfurating and frothing reagents, such as are used in the usual oil flotation processes are added to the pulp and the mixture is subjected to mechanical agitation and aeration. These reagents may be added separately or combined, or in the form of a single oil having both frothing and collecting characteristics. In order to stimulate the action on the zinc, copper sulfate may be added as is a common practice. The aeration may be accomplished either mechanically by beating the air into the pulp or by injection of the air under pressure into the pulp or any other desired method, the important feature being that the reagents be brought into intimate contact with the pulp in such a manner and at such a time as to accomplish the necessary chemical reactions and that the oil or oils and the air introduced are introduced in sufficient quantities to produce a froth or foam which has a selective attraction for the valuable minerals and little or no attraction for the undesirable materials or gangue in the pulp. After the agitation and the addition of air has taken place, the pulp is removed by suitable means from the chamber in which agitation has taken place to a chamber wherein the separation of the material into a froth which floats on top of the mixture can take place so that the froth may be permitted to either flow off the top of the mixture or can be skimmed off into a separate container.

The above process can be repeated a plurality of times if desired, to remove the valuable minerals as completely as possible from the waste material in the pulp, the reagents being added in the repetition of the process if found to be necessary to prevent the interfering action of the tarry matter and undesirable oils with the flotation process.

What we claim and desire to secure by Letters Patent is:—

1. A flotation separation process including the addition of a small quantity of oxalic acid and collecting, sulfurating and frothing means to a pulp containing carbonaceous tarry material and oil interfering with flotation of the minerals to be separated, aerating and agitating the mixture and separating said mixture by flotation into a froth and a precipitate.

2. In a flotation separation process the step of adding oxalic acid to a pulp, containing carbonaceous tarry material and oil interfering with flotation of the minerals to be separated, agitating and aerating said pulp and separation of said mixture into a froth and a precipitate.

3. In a flotation separation process the step of adding a small quantity of oxalic acid to a pulp, containing carbonaceous tarry material and oil interfering with flotation of the minerals to be separated, prior to agitation and aeration of said pulp and separation from said mixture of its frothing components with collected elements.

4. A flotation separation process including the addition of oxalic acid to a pulp containing carbonaceous tarry material and oil interfering with flotation of the minerals to be separated prior to the addition of collecting, sulfurating and frothing means thereto, the addition of said means, the aeration and agitation of the resulting mixture and the separation from said mixture of its frothing components and their collected elements.

In testimony whereof we affix our signatures.

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