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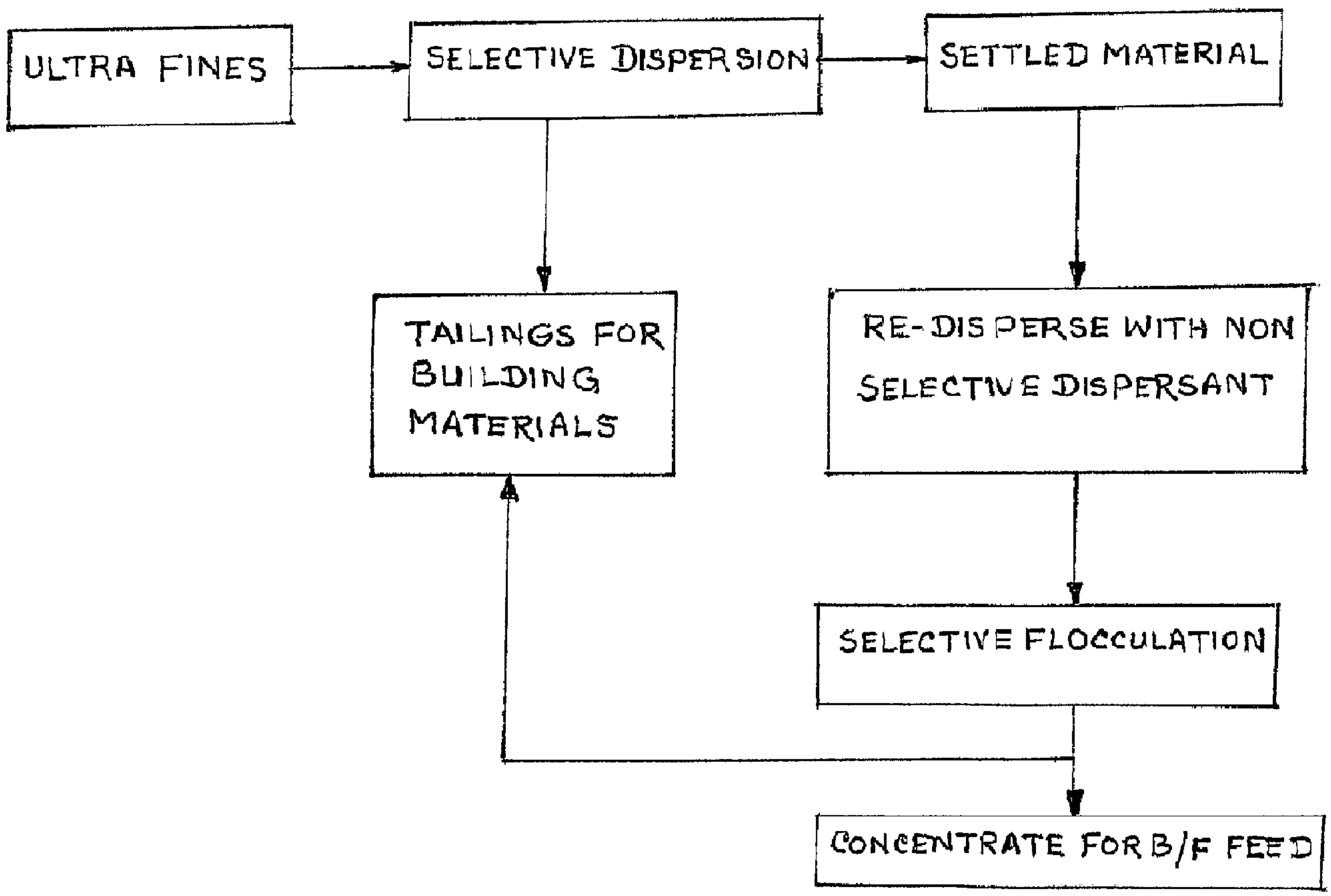
(72) **Inventeurs/Inventors:**
MANNA, M., IN;
BANERJEE, P. K., IN

(73) **Propriétaire/Owner:**
TATA STEEL LIMITED, IN

(74) **Agent:** RIDOUT & MAYBEE LLP

(54) **Titre : PROCEDE DE FABRICATION D'UNE ALIMENTATION DE GRANDE QUALITE POUR HAUT FOURNEAU A PARTIR D'ULTRAFINES DE MINERAI DE FER DE BASSE QUALITE**

(54) **Title: A PROCESS FOR PRODUCING HIGH GRADE BLAST FURNACE FEED FROM POOR GRADE IRON ORE ULTRA FINES**



(57) **Abrégé/Abstract:**

A process for producing high grade blast furnace feed from poor grade iron ore ultra fines consists of processing ultra fines by selective dispersion to separate gangue materials from settled material iron and processing settled material of iron by re-dispersing

(57) **Abrégé(suite)/Abstract(continued):**
with non-selective dispersant The dispersed settled material is then processed by selective flocculation with modified starch to separate concentrate iron for blast furnace feed from tailings leaving the gangue minerals in the dispersed phase. The process of separation between iron bearing minerals and the gangue minerals is carried out on the basis of surface charge conditions at a particular pH during re-dispersing with non-selective dispersant and segregating the finer particles by hydro-cyclone process for better flocculation to produce the final product that contains 68% Fe, 1% alumina and 1% silica.

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(71) Applicant *(for all designated States except US)*: **TATA STEEL LIMITED** [IN/IN]; Jamshedpur 831 001 (IN).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **MANNA, M.** [IN/IN]; Tata Steel Limited, Research and Development Division, Jamshedpur 831 001 (IN). **BANERJEE, P.K.** [IN/IN]; Tata Steel Limited, Research and Development Division, Jamshedpur 831 001 (IN).

(74) Agent: **DAVAR, G.S.**; 32, Radha Madhab Dutta Garden Lane, Kolkata 700 010, West Bengal (IN).

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(54) **Title**: A PROCESS FOR PRODUCING HIGH GRADE BLAST FURNACE FEED FROM POOR GRADE IRON ORE ULTRA FINES

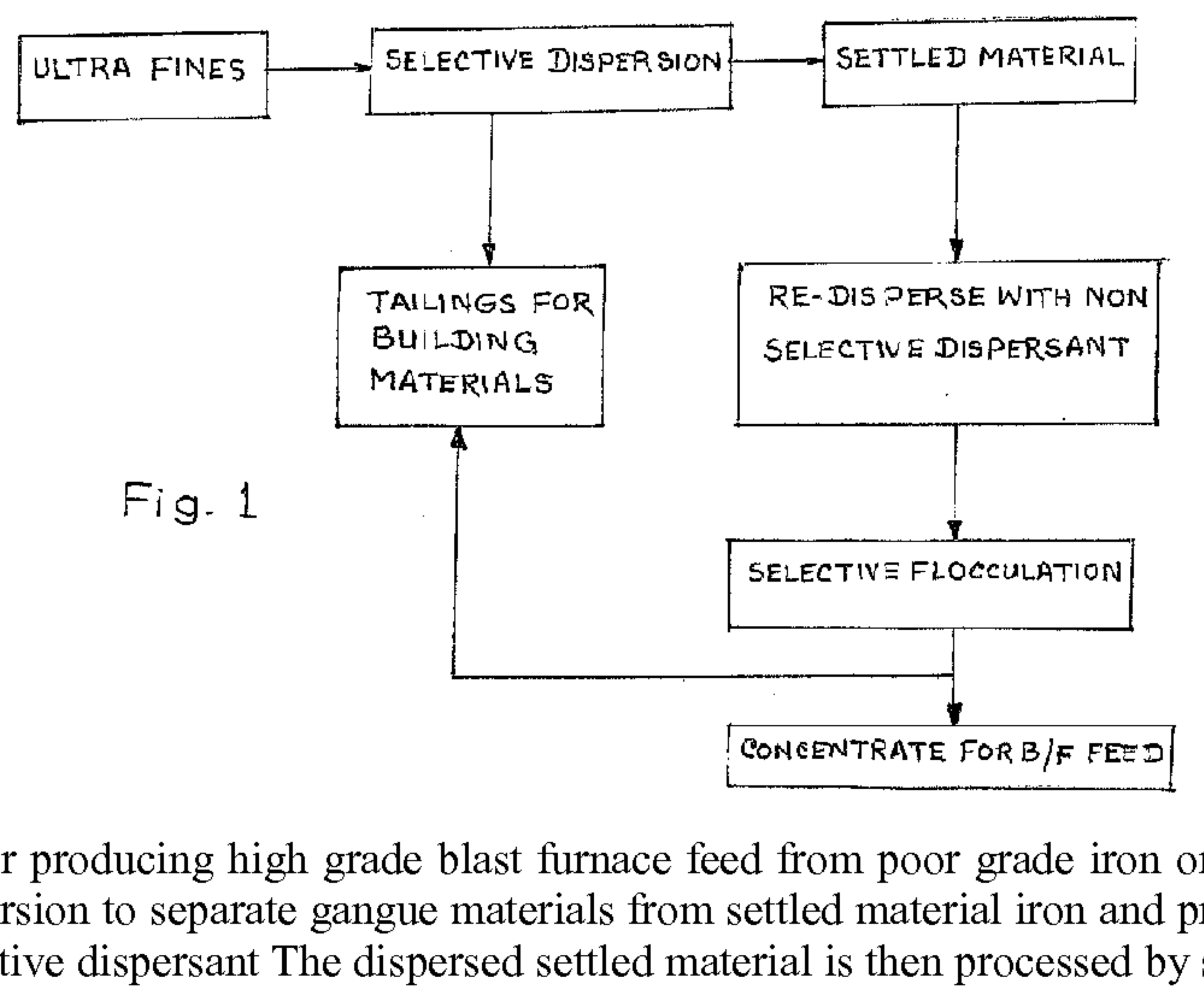

Fig. 1

(57) **Abstract**: A process for producing high grade blast furnace feed from poor grade iron ore ultra fines consists of processing ultra fines by selective dispersion to separate gangue materials from settled material iron and processing settled material of iron by re-dispersing with non-selective dispersant The dispersed settled material is then processed by selective flocculation with modified starch to separate concentrate iron for blast furnace feed from tailings leaving the gangue minerals in the dispersed phase. The process of separation between iron bearing minerals and the gangue minerals is carried out on the basis of surface charge conditions at a particular pH during re-dispersing with non-selective dispersant and segregating the finer particles by hydro-cyclone process for better flocculation to produce the final product that contains 68% Fe, 1% alumina and 1% silica.

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FIELD OF INVENTION

The present invention relates to a process for producing high grade blast furnace feed from poor grade iron ore ultra fines. More particularly, the invention relates to a process of separation of iron bearing minerals from gangue minerals contained in ultra fines by selective dispersion and selective flocculation process.

BACKGROUND AND PRIOR ART OF THE INVENTION

Large quantities of ultra fines are generated during mining and washing of iron ores. At present 11 million tons of these ultra fines have accumulated at various slime ponds. Ultra fines contain iron with high alumina and silica generated in the iron ore mines and the iron ore washing plants. These materials contain iron bearing minerals namely hematite, goethite and magnetite and the gangue materials composing of mostly clay and other alumina silicates. The fined grained clay mineral poses difficulties in beneficiation of these off grade fines to make it suitable for blast furnace feed, because the fines generated in the iron ore mines and also in the iron ore washing plants do not satisfy the stringent specifications of raw materials to be fed into the blast furnace.

The prior art discloses process of separation between two elements namely iron and alumina or iron and silica or alumina and silica from compounds where these items exist in different forms.

Therefore there exists a need to produce quality raw materials from the ultra fines to make it suitable for blast furnace feed which will be of great economical significance by separating iron from alumina and silica contained in ultra fines.

OBJECTS OF THE INVENTION

Therefore it is an object of the invention to propose a process for producing high grade blast furnace feed from poor grade iron ore ultra fines which is capable of separating iron from alumina and silica present in ultra fines for blast furnace feed.

Another object of the invention is to propose a process for producing high grade blast furnace feed from poor grade iron ore ultra fines which makes it environmental friendly with zero waste.

Yet another object of the invention is to propose a process for producing high grade blast furnace feed from poor grade iron ore ultra fines which is capable of separating iron from ultra fines that qualifies for blast furnace feed having less than 2% alumina and silica.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWING

Fig. 1 - shows a flow chart describing the process according to invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

According to the invention, a process has been developed for producing concentrate containing very high iron with very low alumina and silica from the ultra fines containing high alumina and silica generated in the iron ore mines and the iron ore washing plants. In this process, alumina and silica are selectively dispersed whereas the iron bearing minerals are selectively flocculated under specific conditions. The final product contains more than 68 % Fe with only around 1.2% alumina and 1.3% silica from the ultra fines containing around 57% Fe, 7.51% alumina and 7.15% silica, with iron recovery from 45-75%. The tailings generated in this process can be utilized as building materials. This process is environmental friendly with zero waste.

Quality of the raw materials for the iron and steel industries plays an important role in the down stream processes. The fines generated in the iron ore mines and also in the iron ore washing plants do not satisfy the stringent specifications of raw materials to be fed into the blast furnace. It is therefore necessary to beneficiate these off grade fines to make it suitable for blast furnace feed. In the process of upgrading this ultra fines, with low gangue minerals containing low alumina and silica which would be suitable raw materials to be feed into the blast furnace. At the same time some part becomes rich in gangue materials containing high silica and alumina which may be useful for making building materials. The fine grained clay mineral poses difficulties in beneficiation Selective dispersion followed by selective flocculation has been considered to be the most suitable beneficiation process for these materials due to the fineness of the materials. The characterization studies of these ultra fines show that the particles are mostly below 35 micron and the major constituents are iron oxide, alumina, silica, alumina-silicates and iron-alumina silicates. Since the surface charge on the gangue minerals (silica and alumina-silicates) are quite different from that on iron oxide, at a particular pH, separation between iron bearing minerals and the gangue minerals can be done on the basis of surface charge conditions. In addition to the above consideration, a starch flocculant can be used to selectively agglomerate the iron bearing minerals leaving gangue minerals in the dispersed phase.

In the present invention suitable flocculation process has been developed on different grades of slime material. The concentrate will be useful feed material for iron making through blast furnace route where as tailing will be suitable feed material to manufacture building material.

The difference in surface charge of the iron bearing minerals and the gangue minerals has been utilized first to separate out some part of the gangue minerals present in the ultra fines. In the second stage, the materials from the first stage have been subjected to the selective flocculation by using modified starch. By this process, value added products, the concentrate becomes the raw material for blast furnace and the tailing containing high alumina and silica becomes building materials.

As shown in figure 1, ultra fines are subjected to selective dispersion process which separates tailings with higher alumina and silica from settled material comprising mainly of iron with some tailings. This is then subjected to re-dispersing process with non selective dispersant. In the next stage, the materials from the first stage is subjected to a selective flocculation by a flocculating agent like modified starch which separate out iron rich concentrate from further left out gangue materials of clay, alumina and silica which goes out to tailing already collected. Now this concentrate of iron can be used for blast furnace feed. The gangue materials containing high silica and alumina thus separated can be used for building material so that no wastage results out of the process.

The advantages of the process over prior art are:

1. Separation takes place among three compounds of iron, alumina and silica existing in ultra fines in various forms.

2. The final product containing 68% Fe with only round 1.2% alumina and 1.3% silica from the ultra fines is qualified as blast furnace feed. More than 2% of alumina and silica disqualifies the product as blast furnace feed.

Iron containing ultra fines is the mixture of Fe, Si,Al oxide with different particle size. The particle size of ultra fines is in the range of 100 micron to 100 nm. Both the alumina and silica levels in ultra fines are in the range of 3 to 8 wt.%.

The dispersant used includes selective and non-selective dispersant with different dosage. The selective dispersant includes polymer of 5000 to 10,000 molecular weight. The non-selective dispersant includes sodium silicate and sodium hexameta phosphate. The dosage of dispersant is in the range of 20 to 10,000 ppm. The flocculants includes different starch solution with varied dosage in the range of 20 – 10,000 ppm. The starch includes potato, wheat and maize while the starch solution used is plain as well as caustic starch solution with starch concentration in the range of 0.1 to 10 wt%. The process is feasible under varied pH condition when the range of pH is 2.5 to 11 with a preferred pH range as 8-10. The concentration of ultra fines in this process is in the range of 2 to 25 wt% . The settling time of the process also varies from 10 seconds to 20 hours. The method of mixing is carried out either by magnetic stirring, mechanical stirring or mixing the ultra fines in solution using ultra sound. The solvent includes tap water, distilled water, double distilled water.

By this process of selective dispersion and selective flocculation, the alumina and silica levels in concentrate iron has been dropped down to a level of 1 whereas both the alumina and silica level in tailing can be up to 14 wt.%.

From the present invention, various grades of rejected ultra fines can be separated out into two (1) iron rich concentrate and (ii) tailing (with rich in alumina and silica) by selective dispersion and selective flocculation process. The concentrate is most suited feed material for iron making through blast furnace rout whereas the tailing is the most suited feed material to make building material. Added advantage is that this process is environmental and eco friendly with zero waste.

Movement of different particles of oxide mineral in solution depends on degree of surface charge/zeta potential of those particles. Particles are expected to be coagulated or settled if surface charge/zeta potential becomes zero. Surface charge/zeta potential characteristics of iron bearing minerals (hematite, goethite and magnetite) are quite different from clay minerals (alumina and silica) under different conditions. This variation can be shorten or extend by varying pH and using different chemicals. Using all this conditions alumina level in rejected ultra fines can be drop down to 4. This material is unsuitable as feed material for operation of blast furnace.

In this present invention, better charge neutralization happens when particles are made finer. Hence segregating the finer particles of iron oxide, alumina and silica by hydro cyclone process and subjecting that to selective flocculation, the final product that contains 68% Fe, around 1.2% alumina and 1.3% silica is obtained that qualifies as blast furnace feed.

WE CLAIM

1. A process for producing high/qualified grade blast furnace feed from poor/disqualified grade iron ore ultra fines, comprising:

   processing the ultra fines by selective dispersion to separate gangue materials from settled material comprising iron;

   processing the settled material after separation of the gangue materials by re-dispersing the settled material with a non-selective dispersant;

   processing the settled material after said re-dispersing by selective flocculation with modified starch to separate concentrate iron for blast furnace feed from tailings, leaving the gangue minerals in a dispersed phase;

   wherein a separation between iron bearing minerals and gangue minerals is carried out on a basis of surface charge conditions at a particular pH during said re-dispersing with the non-selective dispersant, and segregating finer particles by a hydro cyclone process for better flocculation to produce a final product that contains 68% Fe, 1.2% alumina and 1.3% silica.

2. A process as claimed in claim 1, wherein the selective dispersant is a polymer of 5,000 to 10,000 molecular weight and the non-selective dispersant includes sodium silicate and sodium hexameta phosphate, wherein the dosage of said dispersant is in the range of 20 to 10,000 ppm.

3. A process as claimed in claim 1, wherein the dosage of flocculants is in the range of 20 to 10,000 ppm and includes a starch solution having a concentration of said starch in the range of 0.1 to 10 wt%.

4. A process as claimed in claim 1, wherein the starch includes potato, wheat and maize and the starch solution is plain as well as caustic starch solution having starch concentration in the range of 0.1 to 10 wt%.

5. A process as claimed in claim 1, wherein the pH is 8-10.

6. A process as claimed in claim 1, wherein the concentration of ultra fines in solution is in the range of 2 to 25 wt%.

7. A process as claimed in claim 1, wherein the settling time is in the range of 10 seconds to 20 hours.

8. A process as claimed in claim 1, wherein the mixing process comprises magnetic stirring, mechanical stirring or mixing the ultra fines in solution using ultra sound.

9. A process as claimed in claim 1, wherein the solvent is tap water, distilled water or double distilled water.

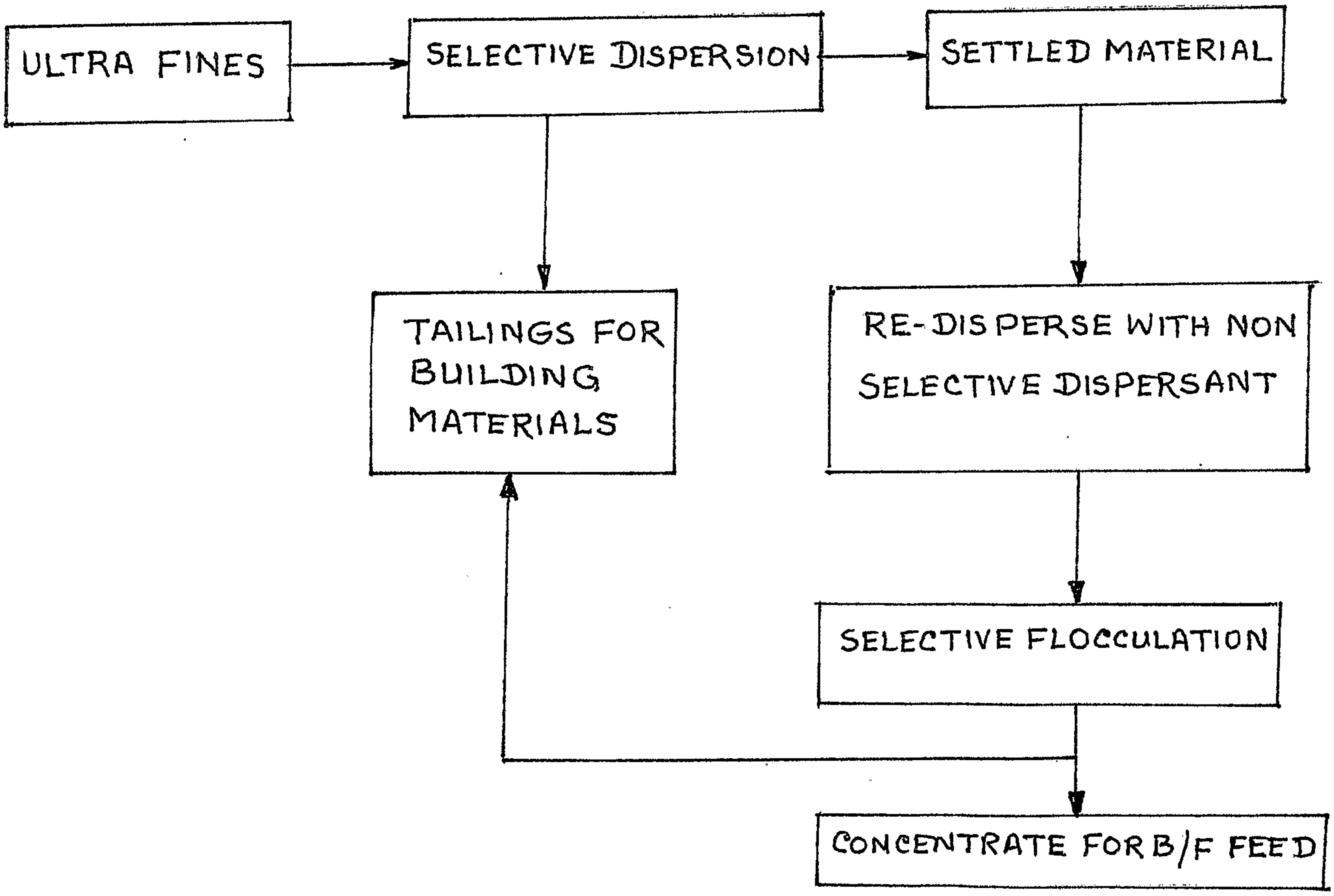
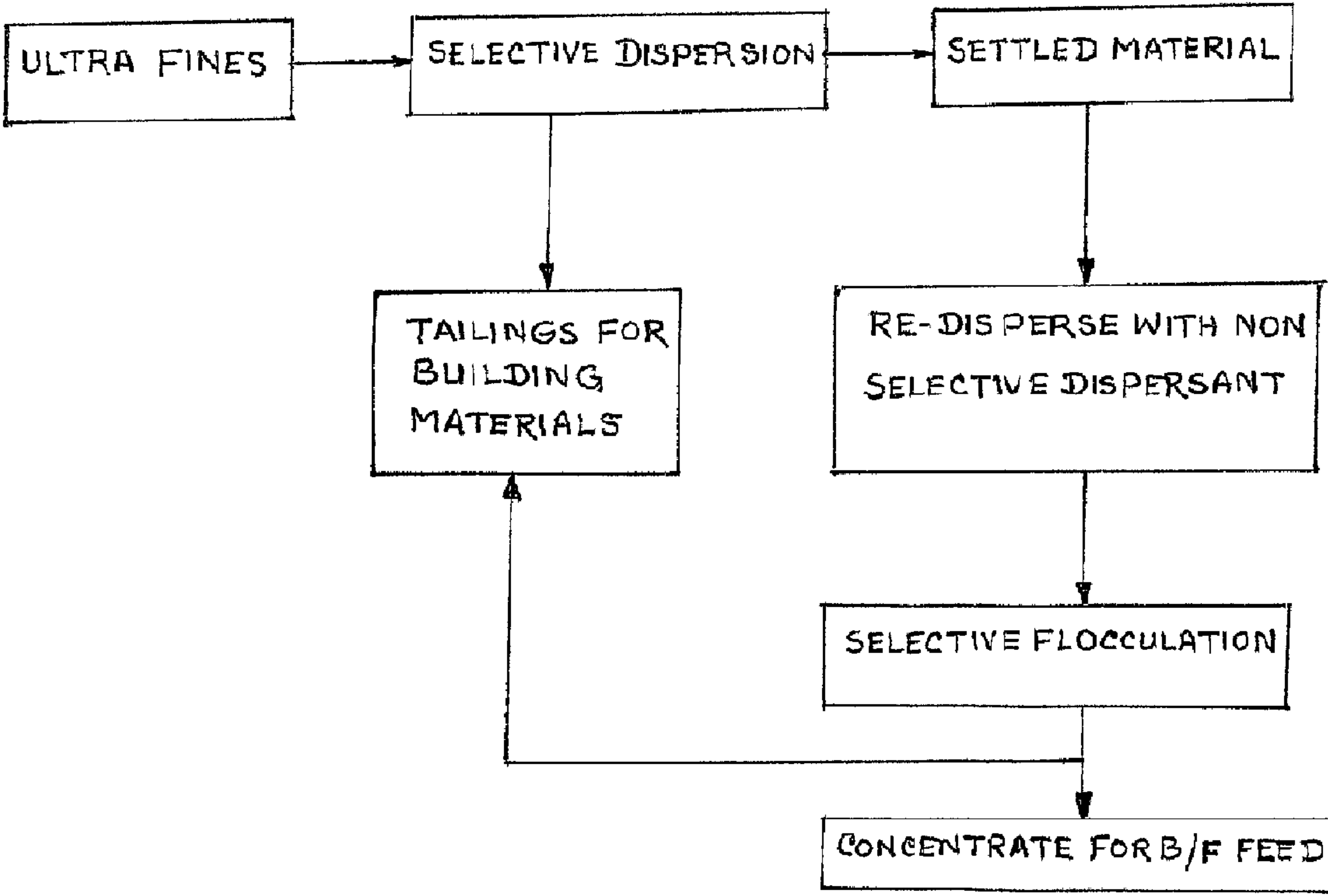

ULTRA FINES
SELECTIVE DISPERSION
SETTLED MATERIAL
TAILINGS FOR BUILDING MATERIALS
RE-DISPERSE WITH NON SELECTIVE DISPERSANT
SELECTIVE FLOCCULATION
CONCENTRATE FOR B/F FEED

Fig. 1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