Stainless Steel in mining applications

Screening of fine aggregates

According, Anefa, National Association of Aggregate Manufacturers, in 2014 every Spaniard consumed 1,900 kilos of aggregates without being aware of it. It is the second most consumed raw material by humans after water.

Stainless steel is a material widely used in mining industry for its special features. In this section, we will stop in the treatment of aggregates, in the screening stage for the construction industry and civil engineering.

It is commonly called arid to a rock that after an industrial process is simply classified by size, in the case of natural or crushed, grinded and classified in the case of aggregates crushing. The case of crushing is used in applications ranging from the preparation of concrete, mortar and asphalt agglomerates, together with a binder material or even in the construction of (sub) base for roads, (sub) ballasts for railway or jetties for the defense and construction of seaports. It consists of rock grains ranging from the almost impalpable powder of 60 microns in diameter to larger fragments, whose maximum dimension can reach several meters.

Mining aggregate processing facilities involve a number of steps: (Figure 1):

Crushing: where the process begins and the material is subjected to a first size reduction which uses equipment such as jaw crushers, or roller cones.

Grinding: it is a process where the material undergoes a second size reduction to obtain a finer particle size. Rod mills or ball mills are used.

Classification: it is the separation of the fractions of the material by size. Depending on the size, the material has a different process. For this purpose are used screens of different mesh sizes that retain the different lots.

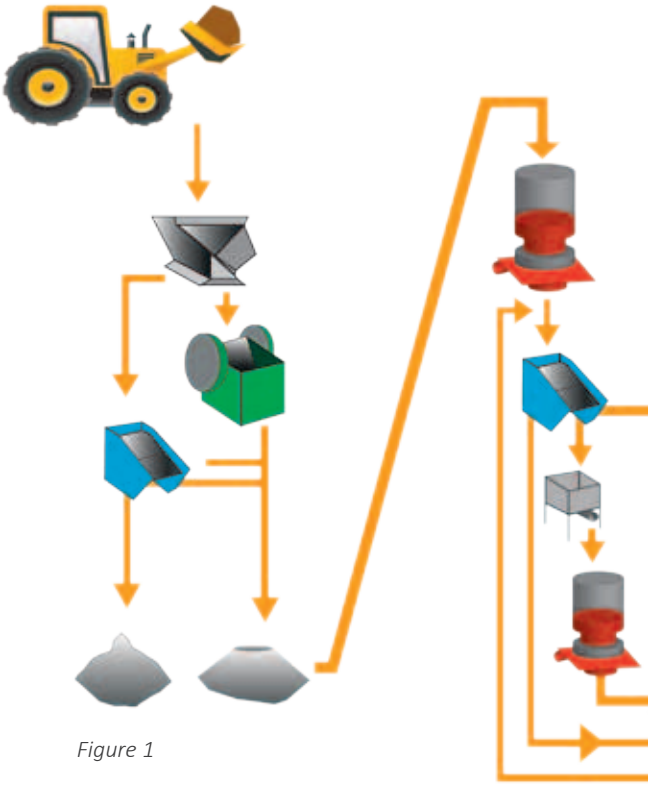
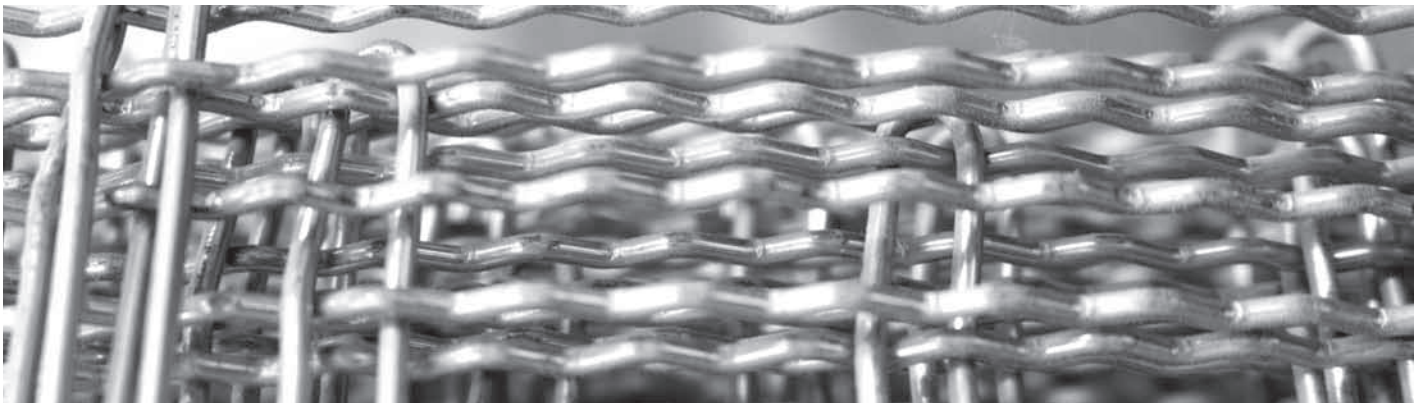


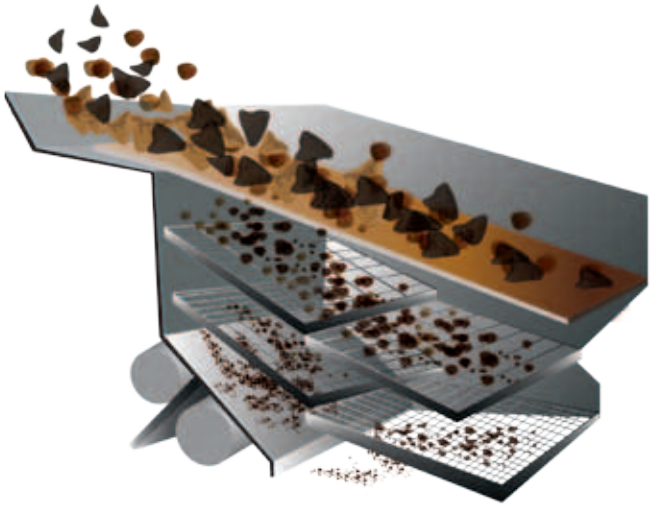
Figure 1

One of the most common problems when screening operations are performed, is the clogging (obstruction or closing of the mesh openings with the product), especially when it comes to fine aggregates. This problem is most critical in the last layers of screening.

Obstruction can occur when the mesh is close to the size of the material to be screened. This problem is mitigated due to the effect of vibration. When the material is soft can be broken into smaller parts.

Another cause of obstruction occurs as a result of the aggregation of fine and wet material in the wires forming the mesh. The fine aggregate material increases its size until it completely closes the mesh openings, this phenomenon can end clogging the mesh as a whole. To avoid this problem, apart from the aforementioned vibration, it should be performed a prior drying of the material.





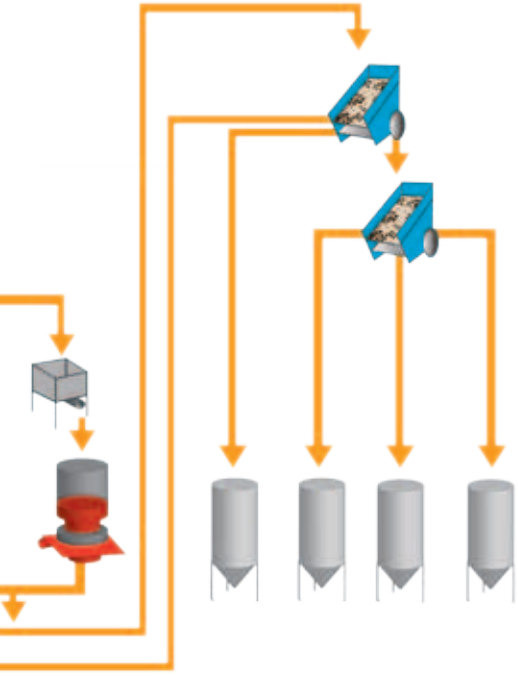


Figure 2: while the screen vibrates different grain sizes of material pass or are retained, leaving the thicker in the upper mesh.

The parameter to measure the effectiveness of a screen is the rate of passage of material through it, and it depends on several factors such as friction, adhesion and impurities.

The stainless steel for screening is especially used in case of fine aggregates, where its use is preferred as the most profitable decision.

It is considered that fine aggregate is the material passing through a mesh size of 4.76 mm. This very fine material is used in many applications among which stand concretes and mortars.

For screening of fine aggregates up to 3 mm, stainless steel is presented as the best alternative to other materials such as high strength carbon, for the following reasons:

1. Corrosion resistance: oxide in carbon steels tends to increase the volume, reducing the mesh size. This is more easily clogging and reducing the effectiveness of screening.

2. Stainless steel does not require any tempering treatment, which would make it more sensitive to abrasion.

3. Stainless steel has excellent surface quality, resulting in lower adhesion of materials when passing the mesh. For materials of low weight to be screened, adherence is a major problem.

4. It allows a smaller diameter wire for a mesh with the same mechanical requirements, reducing significantly the cost.

5. Durability, since in this type of complex installations a mesh change or repair carries high time and cost.

6. The high ductility of stainless steel allows anti clogging meshes, where the wires act as “guitar strings” opening and closing as required, subsequently recovering its initial position.

7. The stainless steel is capable of maintaining its mechanical properties intact with high temperatures for longer than other materials.

For aggregates bigger than 3 mm, less complex and less costly repair facilities, stainless steel also appears as a very reasonable alternative in terms of durability. New stainless steel types with lower alloyed chemical compositions are suitable options to be considered.