G. GRÖNDAL.

LIXIVIATION OF GRANULAR AND PULVERULENT MATERIAL.

APPLICATION FILED JULY 15, 1919.

1,363,970. **Patented Dec. 28, 1920.**

Fig 1.

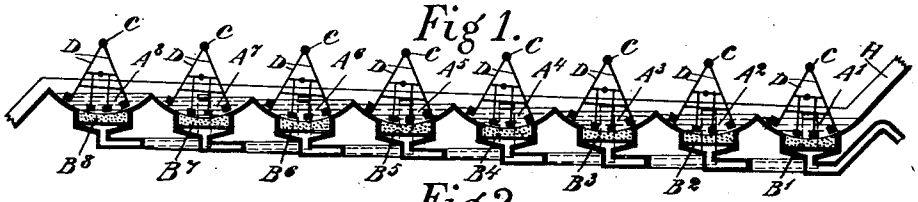


Fig 2.

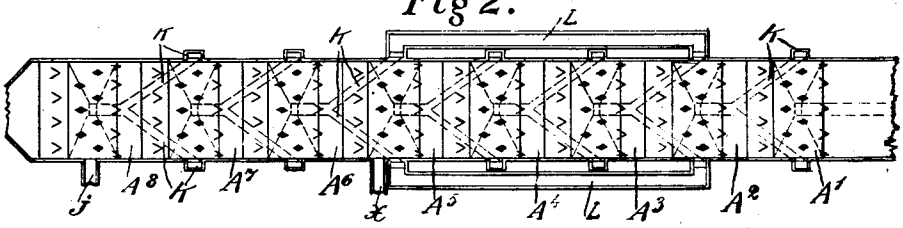


Fig 3.

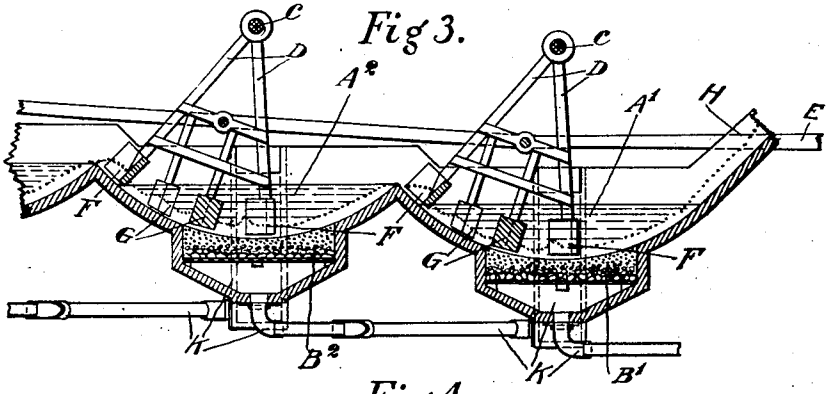
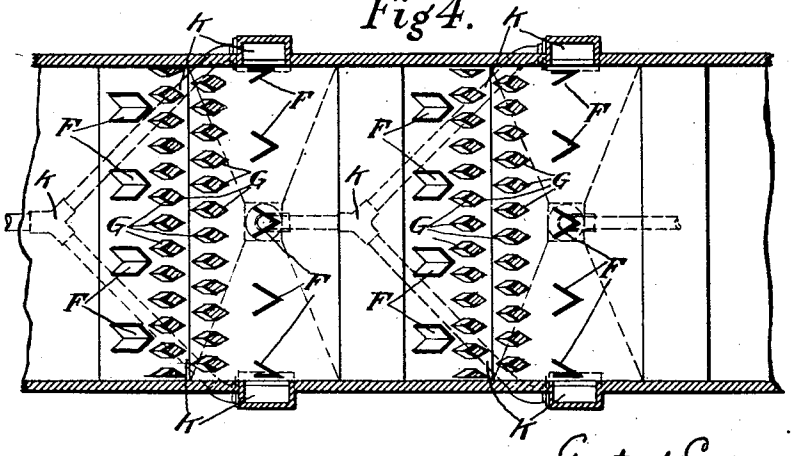


Fig 4.



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LIXIVIATION OF GRANULAR AND PULVERULENT MATERIAL.

1,363,970. Specification of Letters Patent. Patented Dec. 28, 1920.

Application filed July 15, 1919. Serial No. 311,070.

To all whom it may concern:

Be it known that I, GUSTAF GRÖNDAL, engineer and doctor of philosophy, of Djursholm, Sweden, having invented certain new and useful Improvements in Lixiviation of Granular and Pulverulent Material, do hereby declare that the following is a full, clear, and exact description of the same.

This invention relates to an improvement in the lixiviation of granular and pulverulent material as for instance copper ore that has been subjected to a chlorinated roasting, and has for its object a new and useful apparatus for the effecting of said lixiviation.

In lixiviation of materials as mentioned above one has hitherto almost exclusively been limited to the use of vats provided with a perforated false bottom on which a suitable filtering material is placed; on this bottom the material is laid and a suitable solvent is fed into the vat. After the solvent has acted on the material for a shorter or longer time it is drawn off by means of a cock arranged under the false bottom and a fresh quantity of solvent is fed on to the material, and the treatment is repeated until the material has been lixiviated and washed more or less completely. It is evident that with such a method the lixiviation is relatively slow since only a relatively small quantity of solvent comes into direct contact with the material as a stirring of the latter can not as a rule be effected. Besides, such a lixiviating method requires a very great attention and care for feeding and drawing off the solvent, especially if several different solvent agents are employed, and the work in filling the material into the vats and removing it from them also is very troublesome. To this comes, when a plurality of vats is being used, a great difficulty of arranging the transport of the material to and from the vats in a rational manner.

According to my invention the lixiviation and washing is effected continuously under a continual stirring of the material and with as large a quantity of the solvent as desired, it being possible to employ different solvents at the different stages of the process. As the apparatus in practice can be made of any capacity it may replace a great many vats. By this the transportation of the material to and from the apparatus is considerably facilitated. As the feeding and removal of the material is effected automatically the work to this purpose is eliminated and as the whole process of lixiviation is continuous the work necessary for the process is reduced to a supervision of the mechanical means.

A form of apparatus is represented on the accompanying drawing as an example only. Figure 1 is a longitudinal section of the apparatus and Fig. 2 shows the apparatus from above in a section on line 2—2 of Fig. 1. Figs. 3 and 4 show in longitudinal and transverse sections a part of the apparatus on an enlarged scale.

A^1, A^2, A^3 . . . are vats or troughs, whose bottoms are formed after the curved surfaces of cylinders whose axes coincide with the axes of the shafts C, C, C . . . On the said shafts C, C, C . . . arms D, D, D . . . are mounted having feeding members F, F, F . . . and stirring members G, G, G . . . attached to them. I prefer to make the feeding members F, F, F . . . in the form of V-shaped plates whereas the stirring members G, G, G . . . are given a rhombic section. The shape of the members can be varied, however, without departing from the spirit of the invention and it is not necessarily limited to the form shown. The essential feature of the feeding members are that when given a reciprocating movement they transport the material forward. The stirring members have for purpose to mix the material more intimately with the solvent. When given a forward movement the V-shaped plates carry the material on toward the next vat, when moving backward they push the material to the sides, and the stirring members plow through the material causing it to mix thoroughly with the solvent or washing agent. The material fed through a hopper (not shown) is thus carried toward the other end of the lixiviation vat A^1 from where it is transferred to the lixiviation vat A^2 lying a little higher, and so on until at last the lixiviated and washed material in the lixiviation vat A^8 is removed from the apparatus and transferred to a shaking trough (not shown) for removing the water. The solvents effecting the lixiviation and washing respectively pass through the apparatus in opposite direction to the material. Each of the lixiviation vats is placed at a different level in

such a manner that the vat in which the material enters first is at the lowest level and each following vat in succession is at a higher level, the last vat in the series occupying the highest level. The solvent and washing agents pass the material in counter-stream under the action of gravity only and it is possible to employ different solvents in the several vats and to combine different solutions with each other.

In the construction shown each vat is provided with a filter B at its bottom. From the space under the filters conduits K, K, K lead to another, lower, vat. Thus the solution passing from vat to vat is kept free from suspended particles of ore. It is obvious that if only the last vat is provided with a filter the solution can be made to flow off from the plant free from suspended particles and the apparatus may be constructed accordingly. Also it is possible to quite dispense with the filters and stirring members. This may be the case if the ore to be treated is in a granular state and the feeding members move slowly enough. But to make the plant more efficient it is generally necessary to arrange stirring members on the arms so as to increase the time during which the ore is in contact with the solvent, and then the finer ore becomes suspended into the solvent which necessitates the use of a filter.

Fig. 2 shows an inlet opening I in vat A^8. From this vat the solvent flows through A^7 and A^6 and from there through the conduits K and L to A^2. Another solvent enters in A^5 through X and then flows through A^4 and A^3 to A^2 from where both solvents together pass into A^1 and leave the plant through K^1.

It is clear that the construction shown may be varied without departing from the spirit of the invention.

I claim:—

1. An apparatus for continually lixivating and washing granular and pulverulent ore, comprising a set of vats or troughs with curved bottoms placed in succession at different levels, reciprocating swinging arms with feeding members mounted thereon for transporting the ore from one vat to the next higher vat, inlet openings for the dissolving agent (or agents) to enter the vats, filters at the bottoms of the vats and conduits leading from the under-side of the filters to vats at a lower level and outlet openings for the dissolving and washing agents flowing through the vats in counter-stream to the ore by gravitation only.

2. In an apparatus for continually lixiviating and washing granular or pulverulent ore, comprising a set of vats or troughs with curved bottoms placed in succession at different levels, the dissolving and washing agents flowing through the vats by gravitation only, means for mixing the ore with the dissolving and washing agents and transporting it from each vat to the next higher vat, said means comprising feeding members in the shape of V-formed plates and stirring members of substantially rhombic section said members being fastened to arms to which a swinging movement is imparted by means of a system of reciprocating draft-bars.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses.

GUSTAF GRÖNDAL.

Witnesses:
C. BRODÉN,
ELIS JOHANSSON.