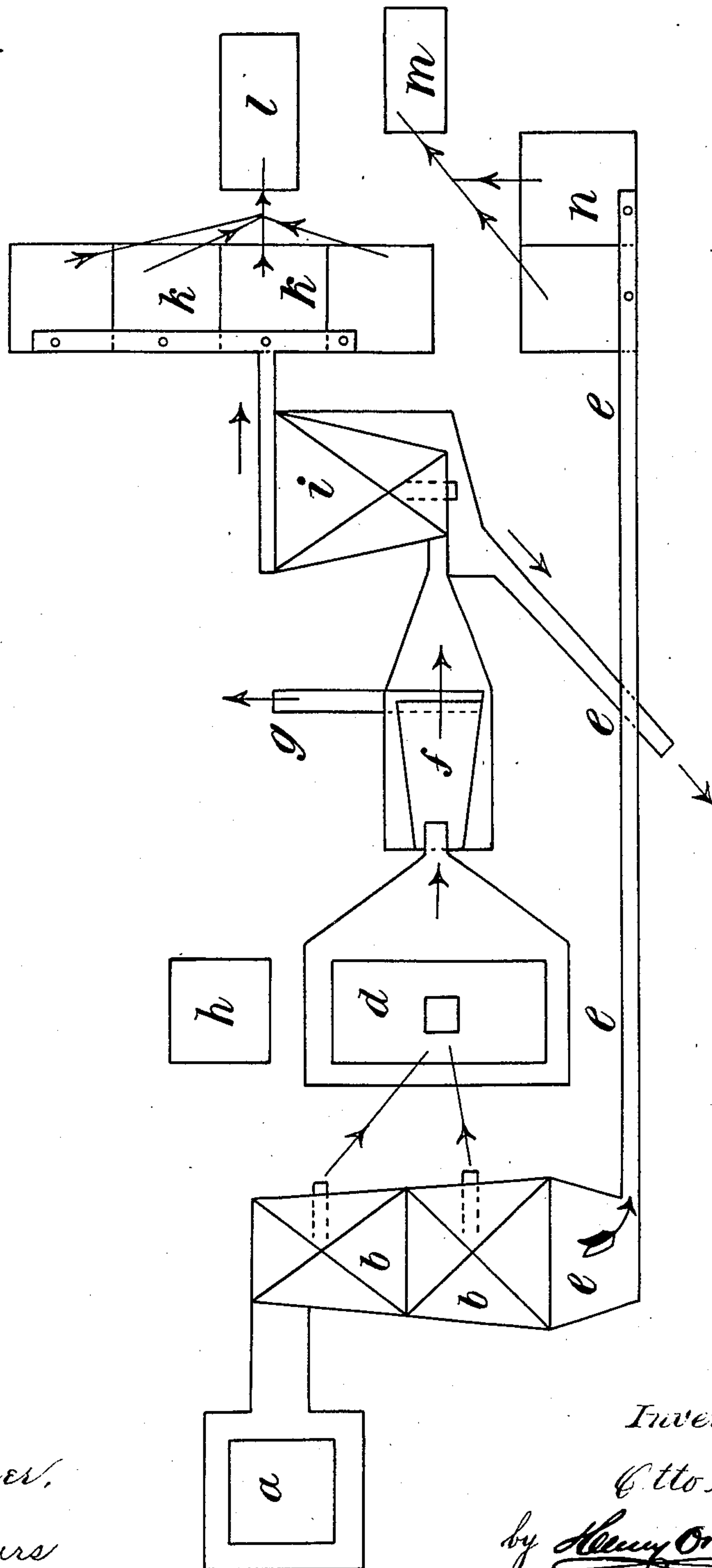


No. 856,124.

PATENTED JUNE 4, 1907.

O. WITT.
METHOD OF DRESSING ORES.
APPLICATION FILED OCT. 24, 1904.



Witnesses.
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UNITED STATES PATENT OFFICE.

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METHOD OF DRESSING ORES.

No. 856,124.

Specification of Letters Patent.

Patented June 4, 1907.

Application filed October 24, 1904. Serial No. 229,785.

To all whom it may concern:

Be it known that I, OTTO WITT, a subject of the King of Norway and Sweden, residing at Kaafjord, Finmarken, in the Kingdom of Norway, have invented certain new and useful Improvements in the Methods of Dressing Ores; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to a method of dressing ores, embedded into or mixed up with rock or minerals of a hardness greater than that of the ore.

My method is based on the different degrees of hardness of the minerals, and aims at obtaining as much as possible of the softer mineral—the mineral containing the metal to be extracted—in form of finely divided slimes, while the harder mineral rests in form of coarser grains, whereupon the two materials of different grains are separated from each other.

Of ores or minerals especially adapted for this process may be mentioned galena embedded in quartz, copper pyrites in iron pyrites, copper pyrites in quartz, molybdenite in quartz, galena in arsenical pyrites, blende in quartz and a great many other mixed ores and compositions.

My method comprises a succession of three distinct processes, viz: 1) A crushing process, whereby the mineral is crushed but avoiding as far as possible the production of slimes. 2) A frictional treatment whereby crushing is avoided, and which treatment is only based on obtaining as much slimes as possible. 3) The separation of the obtained slimes from the coarser grains.

According to my method the raw material is first crushed to a size of grain, in which the ore grains and the rock grains are separated from each other. Then this crushed mass is treated in such a way, that the grains are ground against each other, this treatment being continued until all of the softer material is ground into fine dust. The rock grains, which by this treatment have only their edges a little used off, remain of the same size of grain as before. As a result of this process there is, consequently, obtained two products of different grain, viz. one product in

form of dust comprising all of the softer material, among which the metal or metals, and another product consisting of coarse rock grains.

The method may be carried out in the dry as well as in the wet way. It may also be carried out with the materials only slightly moist. The dressing of the kind of ores in question has heretofore generally been carried out by a crushing process in conjunction with washing processes.

One object of my invention is to dispense with the expensive washing processes involving much labor and loss of ore; an other object is to obtain the ores in a more concentrated state. The ore is obtained in a more concentrated state, from that reason, that I make use of a disintegrating process which does only affect the softer parts, and whereby I practically avoid getting the ore mixed up with rock. On the other hand the rock is in this way as good as wholly freed from ore, whereby losses are minimized.

From experiments on a small scale with copper pyrites in quartz there resulted a rock containing only 0.16% of copper, which is an exceedingly low figure. As confirmed by experiments made by me, one may also advantageously make use of my method as a supplementary process in existing washing plants. As result of an experiment may be mentioned that rock containing 0.5% copper embedded in quartz, was frictionated to a yield of 0.2% of copper, and 0.3% was obtained in the slimes. In a washing plant where 100 tons of rock are worked per day, one may in this way extract metallic copper for about \$80.— per day, whereby the expenses will be minimal, the rock being crushed on beforehand.

My process further enables utilizing the sulfur, the iron pyrite being obtained together with the quartz, and it may be extracted from this mixture in the usual way by washing. A very great advantage is derived from the possibility of carrying out the same without any addition of water. This will be of great importance to mines situated in the high mountains, where water is not accessible. A further advantage is, that when this dry process is used, the buildings inclosing the machinery may be built in the cheapest way, as there is no need of keeping the cold away, where there is used no water. As it will be seen, there are obtained important advantages in dressing the material as indi-

cated above, whereby the ore is obtained as finely divided slimes.

In the following the method shall be described as applied to a special form of carrying out the same, in a more detailed way. If the ore to be treated consists of for instance galena and quartz, there will already during the crushing of the ore be effected a crushing of the galena in smaller grains than the harder quartz. The finest slimes will, accordingly, if separated be richer than the coarser grains. But if the crushing is driven too far, also a large part of the quartz will be mixed in the fine slimes, and diminish the lead percentage of the same. It is therefore important to have the fine crushing effected with as little slimes as possible, in order to avoid having too much of the quartz transferred to the slimes. The next process consists in (after having first removed the slimes of the first process as dressed ore), treating the coarser material by friction. This frictional treatment may preferably be carried out in large drums, suitably with an admixture of a granular material, which is softer than the quartz, but harder than the galena. This admixed material is not able to exert an erosive action on the quartz, grains, but assists the latter in their frictional or erosive action on the galena, which is by and by transformed into very finely divided slimes, the quartz grains maintaining hereby their former size. As a granular material of intermediate hardness may preferably be used iron filings or shavings, which possess the advantage of being easily recovered for renewed ore treatment by magnetic extraction. The wear is trifling. The third process consists in separating the finely divided galena powder from the coarser quartz powder. This is easily effected by first letting the whole mass pass either through a magnetic separator, which removes the iron, or through an ordinary perforated drum, which separates the iron material from both the fine and the coarse materials. The material treated in this way, and freed from the iron is conducted to a separator for instance of the type called in Germany "Spitzlutte," where the coarser material is separated as rock, while the finer material, containing all of the lead, flows over. These slimes are thereupon subjected to treatment in a centrifuge or in a filter press, and are here freed from the whole contents of water, and are now ready for sale as ore with or without previous briquetting.

The process may be executed as well in the dry as in the moist or wet way, only with the difference that instead of separators there are applied air conduits, sieves or other suitable means.

In the accompanying drawings the course of the process is diagrammatically illustrated.

a represents a crushing apparatus of a type, that leaves very little slimes. In this

apparatus the ore is crushed for instance to a size of grain of down to 0.5 millimeters, according to the size of grain, in which the ore grains are deemed to be completely separated from the quartz grains. If the material to be treated contains the ore in large-sized pieces, the size of grain may be considerably larger, from 3 to 6 millimeters. After the crushing process the material is conveyed to the separator *b*, where the slimes contained therein flow over and pass to the receiver *n*, from which they are pumped through the filter press *m*, which produces a comparatively rich ore.

The coarse material from the separator *b* is passed into the drum *d* and mixed with a suitable quantity of iron filings or shavings from the receptacle *h*, whereupon the drum is kept in rotation for so long a time as is needed to get all the galena transformed into fine slimes. For the ore in question the time required for the frictional process will probably not exceed an hour.

From the drum *d* the iron material coarse rock and finely divided galena pass through the drum *f*, which is provided with perforations, permitting the quartz grains and the ore slimes, but not the iron filings, to pass through them. The iron filings leave the drum by a conduit terminating at *g* and are again lifted automatically back to the receptacle *h*, ready for being mixed anew with the material. The rock and the slimes passing through the perforations of the drum *f* go to the washing apparatus *i*. Here the rock is deposited on the bottom and is carried out of the apparatus, while the finer slimes are caught into the receiver *k*, from which they pass through the filter press *l*, where the ore is obtained, pressed into compact plates.

Instead of the drum *d* illustrated in the drawings, it is of course to be preferred to use a longer, slightly inclined rotating drum working continuously, the material entering at one end and leaving at the other. Instead of filter presses one may also use continuously working centrifuges.

As will be seen from the above, the carrying out of the method requires very little manual labor.

The costs of a plant working according to my method will be very moderate, expensive machinery being not required.

Claims.

1. The process of treating or dressing ores, which comprises the crushing of the ores to suitably sized grains, removing the slimes and mixing the crushed ore with a material intermediate in hardness between the gangue and the ore particles, causing the particles to be rubbed together to reduce the more friable ore particles to be reduced to slimes, removing the material of intermediate hardness and separating the slimes from the gangue.

2. The process of treating or dressing ores

which consists in crushing the ore to suitably
sized grains, washing out the slimes with
water, treating the residue with iron filings
to cause the filings and gangue to reduce the
5 softer ore to slimes, magnetically separating
the filings and separating the slimes and
gangue.

In testimony that I claim the foregoing as
my invention, I have signed my name in
presence of two subscribing witnesses.

OTTO WITT.

Witnesses:

ASKR. KVENILD,
SVERRE BERG.