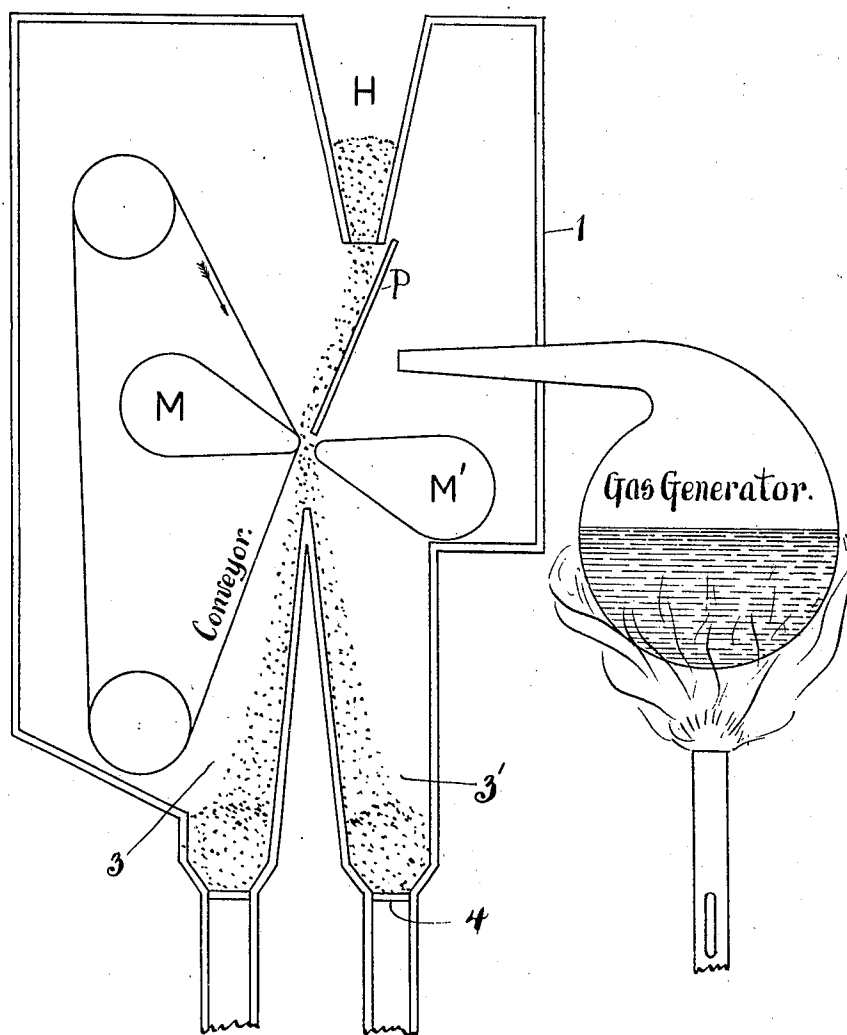


No. 855,895.

PATENTED JUNE 4, 1907.

A. F. KIRSCHNER.
METHOD OF SEPARATING MINERALS.

APPLICATION FILED JAN. 17, 1907.



WITNESSES:

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ADOLPHE F. KIRSCHNER, OF PITTSBURG, PENNSYLVANIA.

METHOD OF SEPARATING MINERALS.

No. 855,895.

Specification of Letters Patent.

Patented June 4, 1907.

Application filed January 17, 1907. Serial No. 352,769.

To all whom it may concern:

Be it known that I, ADOLPHE F. KIRSCHNER, a subject of the Emperor of Austria, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Methods of Separating Minerals, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to electro-magnetic separation of minerals, and its object is to effect the separation by the aid of electro-magnetism of certain grades of ores which have not heretofore been so separated.

Heretofore different characters of ore have been separated from each other or from gang, in a variety of ways, as for example by the chemical process (amalgamation, smelting, etc.); mechanically by hand, or by machinery, with or without the aid of water according to specific gravity; or by electro-magnets according to the magnetic permeability of the minerals.

It is to the last-named method to which the present invention relates, and before specifically describing the novel method to be hereinafter claimed, the following general statement with respect to the prior art and the character of ores is made with the view of rendering the new method the more readily understood. Permeability or magnetic conductivity I call the property of matter to become influenced by a magnet. The permeability of minerals depends largely upon their chemical composition, and varies within vast limits in an unknown proportion relative to the same. With the view to magnetic separation all matter may be divided into three general classes, to wit: first, diamagnetic matter, which under ordinary or general conditions cannot be influenced by an electro-magnet. Second, paramagnetic matter which is readily influenced by an electromagnet, and third, ferromagnetic matter which is also influenced by a permanent magnet. The permeability of diamagnetic matter is less, or equal to that of atmospheric air; the permeability of paramagnetic matter is higher or greater than that of atmospheric air; and the permeability of ferro-magnetic matter is considerably higher than that of atmospheric air. Heretofore many magnetic ore separators have successfully treated ferro-magnetic matter, and by

the aid of auxiliary processes, as calcinations, close sizing, etc. have also treated paramagnetic substances with more or less success, but no result it is believed has heretofore been accomplished with diamagnetic matter, and for the obvious reason that matter of the same, or lower permeability than the medium in which it is suspended cannot be magnetically influenced.

The present invention is based upon the theory that if the permeability of the medium in which the diamagnetic matter is suspended, is decreased the latter can be influenced magnetically, and I have discovered by experiment that some gases are appreciably less permeable than atmospheric air. These gases are diamagnetic.

The improved method consists in inclosing a magnetic field in an air-tight manner in any suitable receptacle and filling the latter with diamagnetic gas. Substances which could not be influenced in the most concentrated field in atmospheric air are readily influenced when suspended in this diamagnetic gas.

The accompanying drawing illustrates an apparatus by the aid of which the method may be practiced. The said drawing illustrates diagrammatically, a chamber or receptacle sealed against atmospheric air by the ore, also illustrating a gas generator communicating with the chamber for supplying a gaseous medium to said chamber. The practice of the invention is, however, by no means confined to the type of apparatus herein shown.

In the practice of the invention, I provide a shell or casing 1, of any desired form, into which ore is fed from a suitable hopper H. It is preferable, though not essential, that the shell or casing be formed with two chutes 3, 3', the former receiving the magnetic particles or concentrates, and the latter receiving the non-magnetic particles, each controlled by a gate 4, which gate may be manually operated, or automatically operated, by the weight of the ore upon the same. Suitably mounted within the shell or casing 1 is a pair of magnets M, M', and arranged to travel over the magnets M is an endless conveyor as shown. The ore within the hopper H and chutes 3, 3', is adapted to seal the interior of the shell or casing 1, and to provide thereby an air-tight compartment into which gas is forced from the gas generator suitably

located with respect to the shell or casing 1 and communicating with the interior of said shell or casing 1.

It will be understood that when a stream of mingled magnetic and non-magnetic particles falls from the hopper H the attraction of the magnets alters the direction of falling of the magnetic particles these falling into chute 3, while the non-magnetic particles fall into chute 3'.

Two magnets are used in order to provide a larger magnetic field for the material to pass through than would be afforded with the use of but one magnet. Furthermore, if but one magnet was used, the magnetic rays would be diffused in all directions, whereas, by employing two magnets and locating the same opposite each other, the magnetic rays will be substantially confined between the magnets. The ore as it leaves the hopper H falls upon an inclined projecting-plate P causing it to be projected toward and onto the endless conveyer. As the endless conveyer travels over magnet M in the direction shown by the arrow, the magnetic particles have a tendency to adhere thereto until they have been carried out of the field of attraction, when they drop by gravity into the chute A.

As heretofore stated, the invention is particularly adapted, though not confined in its use, to the treatment of diamagnetic matter, such as copper, lead and zinc ores, having a permeability equal to or less than that of atmospheric air. By suspending this diamagnetic matter in an air-tight chamber charged with diamagnetic gas or other fluid of lower permeability than atmospheric air, the diamagnetic matter will be readily influenced by the magnet. This will be evident when it is remembered that the permeability of diamagnetic matter is the same or less than atmospheric air, and consequently can not be magnetically influenced in atmospheric air, or, in other words, matter of the same or lower permeability than the medium in which it is suspended, can not be magnetically influenced. When, however, the medium in which the matter is suspended has its permeability decreased materially below the permeability of the matter to be magnetically influenced, the reason for failure of the matter to be magnetically influenced has been removed, and the material or matter is readily influenced by the magnetic action.

The utility and value of this new method of separating minerals will be readily appre-

ciated by those skilled in the art, as by its employment, many mines now unworked may be rendered profitable, and the output of others accordingly increased.

I have found that vapors from turpentine or gases formed by burning wood heavily charged with pitch provide diamagnetic gases suitable for carrying out my improved method.

While I have herein referred to a gas as the medium for decreasing or reducing the permeability of the medium in which the diamagnetic matter is to be separated is suspended, yet I wish it to be understood that I have employed this term in its generic sense, meaning thereby any gas or fluid by means of which the decreased permeability of the suspension medium for the ores is effected.

The improved method or process can be employed in connection with any practical ore separator at small expense, and the operating expenses need be only slightly increased.

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

1. The herein described method of separating minerals from their ores, which consists in suspending the ore within an air-tight space charged with a gaseous medium having lower permeability than atmospheric air, and subjecting the ore while in suspension within said charged space to electro-magnetic action.

2. The herein described process for separating minerals from their ores, which consists in charging an air-tight chamber with a gaseous medium having a lower permeability than atmospheric air, suspending the ore within the charged chamber, and subjecting the ore while in suspension to electro-magnetic action.

3. The herein described process for separating minerals from their ores, which consists in maintaining the ores in suspension within a chamber sealed from the atmosphere, charging the said chamber with a gaseous medium having lower permeability than atmospheric air, and subjecting the ore while in suspension in said medium to electro-magnetic action.

In testimony whereof I affix my signature in the presence of two witnesses.

ADOLPHE F. KIRSCHNER.

Witnesses:

MAX H. SROLOVITZ,
A. J. TRIGG.