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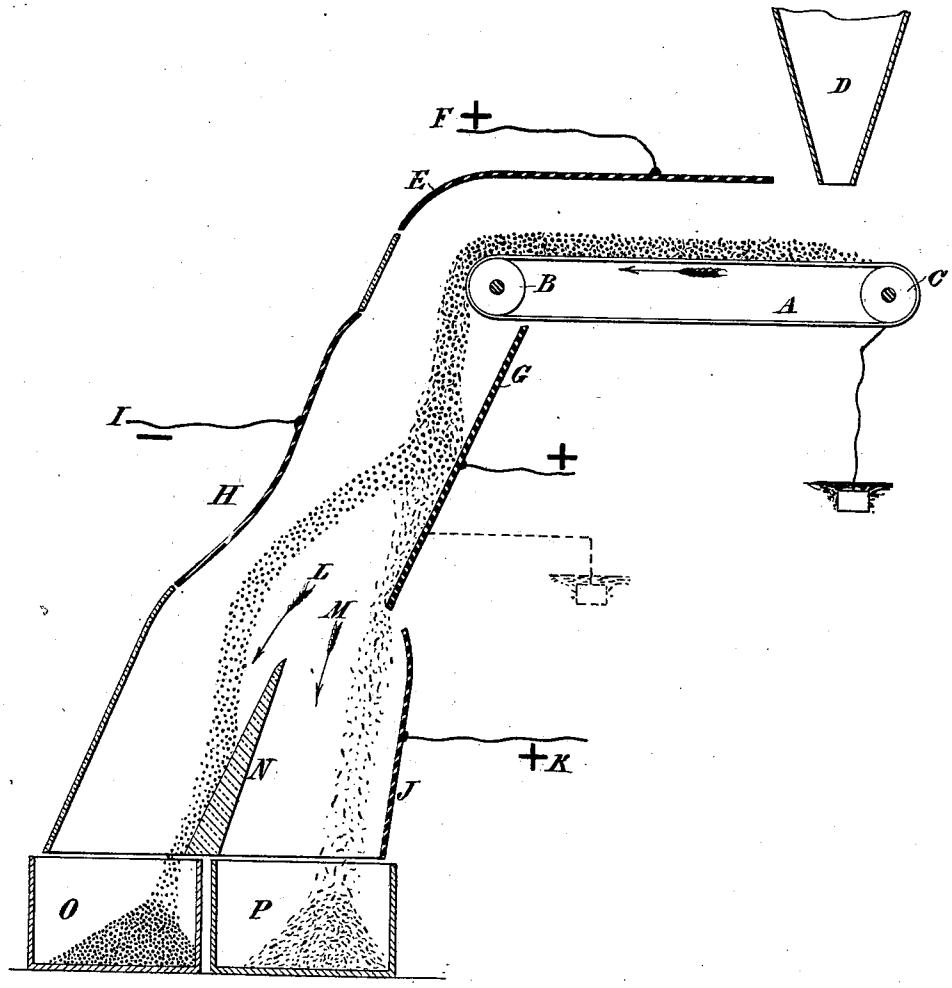
L. I. BLAKE & L. N. MORSCHER.

PROCESS OF ELECTRICAL SEPARATION OF CONDUCTORS FROM NON-CONDUCTORS.

(No Model.) (Application filed Mar. 16, 1899.)



WITNESSES:

Raphael Netter

James D. Carlow

INVENTORS

Lucien I. Blake,

Lawrence N. Morscher

by Robt. F. Gaylord

ATTORNEY.

UNITED STATES PATENT OFFICE.

LUCIEN I. BLAKE, OF LAWRENCE, AND LAWRENCE N. MORSCHER, OF NEODESHA, KANSAS.

PROCESS OF ELECTRICAL SEPARATION OF CONDUCTORS FROM NON-CONDUCTORS.

SPECIFICATION forming part of Letters Patent No. 668,791, dated February 26, 1901.

Application filed March 16, 1899. Serial No. 709,238. (No specimens.)

To all whom it may concern:

Be it known that we, LUCIEN I. BLAKE, of Lawrence, county of Douglas, and LAWRENCE N. MORSCHER, of Neodesha, county of Wilson, State of Kansas, citizens of the United States, have invented a certain new and useful Improvement in Processes of Electrical Separation of Conductors from Non-Conductors, of which the following is a specification, reference being had to the drawing accompanying and forming a part of the same.

The process relates generally to the art of separating particles or grains having a varying or different electrical conductivity—that is, the separation of conductors (or those known as relatively good conductors) from non-conductors (or those having relatively poor electric conductivity.)

An important application of the principle of the invention, as described and set forth herein, is in the separation of particles of precious or other metals and their compounds from sand, silica, slate, or other similar material occurring with metals in a state of nature and also in the recovery of metals or their compounds occurring in waste mixtures—such, for example, as result from various processes of ore reduction.

The principle of the invention is based upon the facts, (which we have fully and practically proved,) first, that when a mass or mixture of conducting and non-conducting particles or grains is brought into an electrostatic field or is charged directly the conductors acquire their inductive or direct charges instantly, while the non-conductors require an appreciable time to become charged; second, that conductors of one potential when brought into contact with conducting-surfaces of different or opposite potential instantly acquire the same potential as the conducting-surface and are repelled therefrom, while the non-conductors require an appreciable time of contact with such surface before acquiring the same potential as said surface and being repelled. It is evident that the greater the difference in potential between the mixed mass and the conducting-surface the more marked will be the repelling action and that if the potentials are of opposite sign the action will be still more marked.

Our invention consists, in general terms, of submitting a mass or mixture of conducting and of non-conducting particles or grains to the action of an electrostatic field or charge of one potential and then submitting the mass to the action of an electrostatic field or charge of another or opposite potential, whereby the conductors quickly acquire the same potential as the surface communicating the final electrostatic charge and are quickly repelled therefrom, while the non-conducting particles acquire the same potential as the conducting-surface so slowly that they pass off at the bottom of the surface before any repelling action takes place. Thus the separating action is due to the difference of time required for the conducting particles and for the non-conducting particles, respectively, to acquire the same potential as the final charging-surface.

Referring to the drawing, the view shown illustrates a section of one form of mechanism designed to practice our process.

A is a flexible belt of electric conducting material driven in any proper way, as by the rolls B and C, and upon which is deposited through the hopper D the mixture or mass to be operated upon—such, for example, as granular metal mixed with sand or similar non-conducting granular particles.

E is a metallic plate or conducting-surface of suitable size and shape extending parallel to and positioned above the belt A, which plate is connected to a source of electrostatic potential F. The space between this plate and the belt A is such as to insure that the mixture being charged by the plate will not be lifted from the belt by electrical attraction.

G is a smooth plate or conducting-surface inclined downwardly from beneath the roll B. This plate in one use of the apparatus is to remain electrically neutral or in electrical connection with a ground.

H is a metallic plate or conducting-surface positioned opposite the plate G and at a distance, practically as is shown by the drawings, and this plate is connected to a source of electrostatic potential I of opposite sign to that

of F. J is another metallic plate arranged below the plate G and sustaining a potential from a source of electricity K of sign opposite that of I.

The mixture of conducting and non-conducting grains or particles is dropped upon the belt and carried in a sheet or stream of practically uniform thickness along under the plate E at a speed sufficient to insure that the mass, especially the non-conducting particles thereof, will receive its full inductive charge before it falls from the belt—that is, a charge of sign opposite that of F. As the mixture falls from the belt it drops through the field produced by the plate H, and as the conducting-plate G is charged by induction from H to the opposite sign from that of the falling mixture upon impact of the mixture on G the conducting particles instantly lose their induced charges obtained while on the belt and instantly receive opposite charges by contact with G, and so are promptly repelled from G, being also attracted by H in the general direction indicated by the arrow L. The poorer conducting materials, however, not having time during their fall along the plate G to give up their charges to the plate or to receive a new charge from G or a charge due to H, are held by attraction to the plate G, and thus glide along the same in the direction indicated by the arrow M, or in a stream separate from that of the conducting particles. As the non-conducting particles leave the plate G they are still farther guided and maintained in a stream or by the action of the charged plate J.

A diaphragm or similar device N may be provided to further insure the separation of the falling streams of conductors and non-conductors, and receptacles O and P may be provided to receive the particles of such streams.

The plates H and J are not essential, although they assist considerably in a practical machine. If these plates be eliminated, then it would be desirable to attach the plate G to a source of electrical energy the sign of which would be the same as that of F.

It is evident that our process may be carried on with other forms of apparatus than that here shown. In an application for Letters Patent, Serial No. 26,152, of 1900, filed August 7, 1900, pending contemporaneously with the present application, we have shown and claimed several forms of suitable apparatus. It is also evident that the conveying belt or surface may be directly connected with the source of electrical energy and the mass thereby directly charged instead of by induction from the plate E, as shown in the form of apparatus here illustrated. It is also evident that if the repelling-plate be electrically charged at a different potential from that acquired by the particles from the electrostatic field caused by the earth the separation of the conducting from the non-conducting particles when the mass is brought in contact with the repelling-plate would take place or tend to take place in the same manner as above described; but commercially it will be desirable to give the mixed matters a first charge of opposite potential to that which it receives from the repelling-plate.

We are aware that it has been proposed to separate the particles of masses such as herein indicated by exposing such masses to electrostatic fields of force with the purpose of separating the lighter particles from the heavier; but in no case that we are aware of has the difference in electrical conductivity between different particles (and irrespective of relative weight or action of gravity) been availed of for the purpose of effecting their separation.

What is claimed as new is—

1. The herein-described process of effecting the separation of the electric conducting particles of a mass from the non-conducting particles of the same, which consists in electrically charging the particles of such a mass by submitting the same to an electrostatic field or charge of one potential, and then subjecting such mass to an electrostatic field or charge of opposite potential, whereby the conducting and quickly-electrified particles are repelled from the non-conducting particles of slow electrification.

2. The herein-described process of separating conducting particles from a mass of non-conducting particles, which consists in conducting a stream of the combined particles or grains through an electrostatic field of one potential, and then through an electrostatic field of another potential.

LUCIEN I. BLAKE.
LAWRENCE N. MORSCHER.

Witnesses:
JOHN Y. H. NORTON,
FRED A. CLARKE.