(No Model.)

T. A. EDISON.

MAGNETIC SEPARATOR.

No. 396,356. Patented Jan. 15, 1889.

Fig. 1.

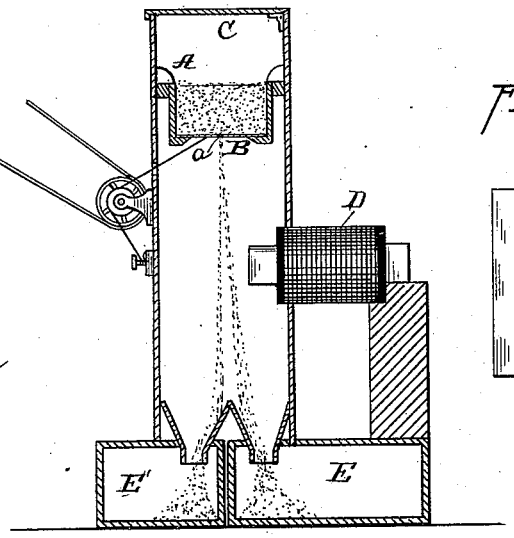


Fig. 2.

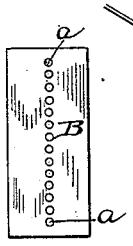


Fig. 3.

Fig. 4.

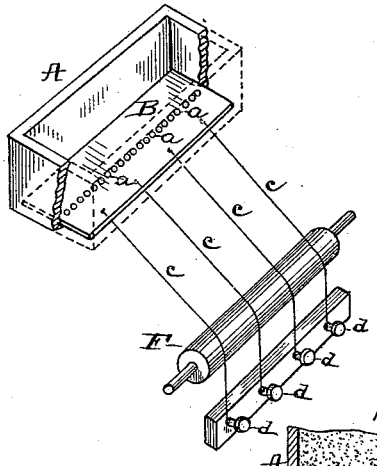


Fig. 5.

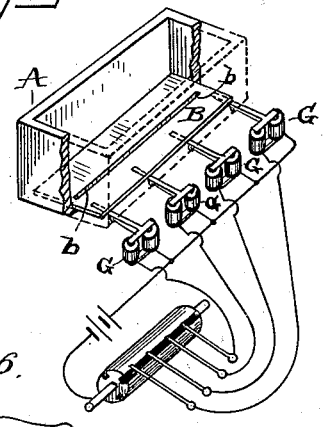
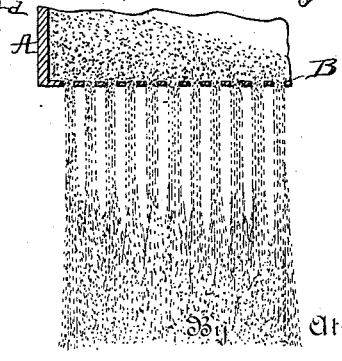


Fig. 6.



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UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY, ASSIGNOR TO THE EDISON ORE MILLING COMPANY, (LIMITED,) OF NEW YORK, N. Y.

MAGNETIC SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 396,356, dated January 15, 1889.

Application filed March 29, 1888. Serial No. 268,749. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citizen of the United States, residing at Llewellyn Park, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Magnetic Separators, (Case No. 767,) of which the following is a specification.

My invention relates to apparatus for separating mingled magnetic and non-magnetic materials of that character in which the mingled substances in a finely-divided condition are caused to fall past the poles of a magnet, whereby the trajectory of the falling magnetic particles is altered and they fall separately from the non-magnetic particles.

My invention relates more particularly to the constructing and arrangement of the hopper used for discharging the material past the magnet-poles. Heretofore V-shaped hoppers have been used for this purpose; but I have found that in that case the normal direction of falling of the particles is not in a straight vertical line, but that they fall in different angular directions and spread out into an irregular mass, which makes it very difficult to act upon them by the magnets in the manner above mentioned. I remedy this by the employment of a flat-bottomed hopper provided with a narrow opening or openings at its middle part. I prefer to have a row of small holes across the bottom of the hopper, though I may have a single narrow slit. I prefer to make the flat bottom of the hopper of thin sheet-brass. When holes are used, the material leaving the hopper falls in a number of distinct vertical streams, and these streams remain separated for a foot or more below the hopper; but the particles being gradually spread apart by the effect of the air, the streams coalesce into a single wide thin mass, the particles composing which are separated from one another, which makes it easy for the magnet to act upon them, so that the direction of falling of the magnetic particles is readily altered and they are readily and completely separated from those which are non-magnetic. When the pulverized ore or other material to be acted upon is very fine, the holes must be very small. For one-hundred-mesh material the holes should be three sixty-fourths of an inch in diameter and one thirty-second of an inch apart. When the holes are so small, the particles do not pass readily through them, and to assist their discharge I prefer to provide means for putting the bottom plate of the hopper into vibration, whereby the particles of material will be vibrated or agitated, which will cause them to be discharged freely.

While, as stated, I prefer to provide the row of small holes in the bottom of the hopper, I may use in some cases a single narrow slit—say three sixty-fourths of an inch wide. In this case the particles remain closer together and the magnetic separation may not be so perfect as with the preferred form, for where the particles are so close together some of the magnetic particles surrounding non-magnetic ones may carry the latter down with them.

My invention is illustrated in the accompanying drawings.

Figure 1 is a view principally in vertical section of magnetic separating apparatus embodying my invention. Fig. 2 illustrates the bottom of the hopper in the preferred form of the invention; Fig. 3, the bottom of the hopper in the form employing a narrow slit. Fig. 4 shows one way of vibrating the hopper. Fig. 5 shows another way, and Fig. 6 is a somewhat exaggerated view in section of a portion of the hopper in its preferred form.

A represents a straight-sided box or hopper whose bottom is a thin metal plate, B. This chamber is preferably placed at or near the top of a closed chamber, C. Below the hopper is placed an electro-magnet, D, so that the material falling from the hopper falls past the holes of said magnet. Below the magnet are placed two bins or receptacles, E and E′. This general form of separating apparatus is shown and described in my prior patents, No. 228,329, dated June 1, 1880, No. 248,432, dated October 18, 1881, and No. 377,518, dated February 7, 1888.

It will be understood that when a stream of mingled magnetic and non-magnetic particles falls from the hopper the attraction of the magnet alters the direction of falling of the magnetic particles, so that these fall into the receptacle E, while the non-magnetic portion of the mixture falls vertically into receptacle E′.

The bottom B of the hopper has either a row of small holes, *a a*, across its middle part, as shown in Figs. 1, 2, 4, and 6, or a single narrow slit, *b*, as in Figs. 3 and 5.

In Figs. 2, 3, 4, and 5 the openings are shown at about their actual preferred width in practice; but it will be understood that this is entirely out of proportion to the size shown for the hopper—that is, the hopper will be very much larger in proportion to the size of the holes than it is shown, and there will be very many more holes in the row; and in Figs. 3 and 5 the slit *b* is shown at about its actual diameter, but it will of course be much longer proportionately than it is shown.

Fig. 6 shows approximately how the material falls from the holes. In this figure the holes are shown at about twice their preferred actual diameter. The mingled material of which the hopper is kept full falls through each hole in a straight stream, such streams being at first distinct from one another; but the particles gradually spread out, so that at a distance of about a foot from the hopper the streams all unite into a wide thin sheet, the particles composing which are separated from one another. At this point I place the magnet, which draws the magnetic particles aside from the rest, as illustrated in Fig. 1.

As stated, it is best in some cases to vibrate the bottom of the hopper. One way of doing this is shown in Figs. 1 and 4. F is a roller, which is revolved by suitable power and which is covered with leather coated with rosin. Over the roller F are stretched a number of wires, *c c*, which are attached to the bottom plates of the hopper and whose other ends are rigidly secured, preferably adjustably, by screws *d*. It will be seen that the turning of the wheel under the wires will give them longitudinal vibrations, which will give molecular vibrations to the plate of the hopper, and the vibrations thus given to the particles of the material will cause the same to fall freely through the openings.

Another way of vibrating the hopper is shown in Fig. 5. Several small electro-magnets, G G, have movable armatures mechanically connected with the bottom of the hopper, and the circuits of these magnets are all controlled by a rotating circuit making and breaking wheel, so that said armatures are caused to vibrate and throw the plate B into vibrations.

It is evident that a permanent magnet is the equivalent of an electro-magnet for the separating purposes of my invention. In my application, Case No. 339, filed August 25, 1882, Serial No. 70,288, is shown a different device for altering the trajectory of falling particles—viz., an electrostatically-charged body for attracting such particles. It is evident that the hopper herein described is useful as well with this kind of apparatus, and that the magnet and the electrically-charged body are equivalents, so far as the present invention is concerned; and I wish it to be understood that under the expression "a magnet" in the claims I include not only the electro-magnet shown and described, but also the above-mentioned equivalents thereof.

What I claim is—

1. In a magnetic separator, the combination of a hopper having a flat bottom and an opening therein, with a magnet below said hopper for altering the trajectory of magnetic material falling therefrom, substantially as set forth.

2. In a magnetic separator, the combination of a hopper having vertical sides and a flat bottom with an opening therein, with a magnet below said hopper for altering the trajectory of magnetic material falling therefrom, substantially as set forth.

3. In a magnetic separator, the combination of a hopper having a flat bottom and a row of small holes therein, with a magnet below said hopper for altering the trajectory of magnetic material falling therefrom, substantially as set forth.

4. In a magnetic separator, the combination of a hopper having a thin metal bottom plate with an opening therein, with a magnet below said hopper for altering the trajectory of magnetic material falling therefrom, substantially as set forth.

5. In a magnetic separator, the combination of a hopper having a thin metal bottom-plate with a row of small holes therein, with a magnet below said hopper for altering the trajectory of magnetic material falling therefrom, substantially as set forth.

6. In a magnetic separator, the combination, with a hopper having a flat bottom with an opening in it and means for vibrating it, of a magnet below said hopper for altering the trajectory of magnetic material falling therefrom, substantially as set forth.

7. In a magnetic separator, the combination, with a hopper having a flat bottom with a row of small holes in it and means for vibrating it, of a magnet below said hopper for altering the trajectory of magnetic material falling therefrom, substantially as set forth.

This specification signed and witnessed this 19th day of March, 1888.

THOS. A. EDISON.

Witnesses:
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A. W. KIDDLE.