No. 823,234. PATENTED JUNE 12, 1906.

H. H. WAIT.

MAGNETIC ORE SEPARATOR.

APPLICATION FILED MAR. 20, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

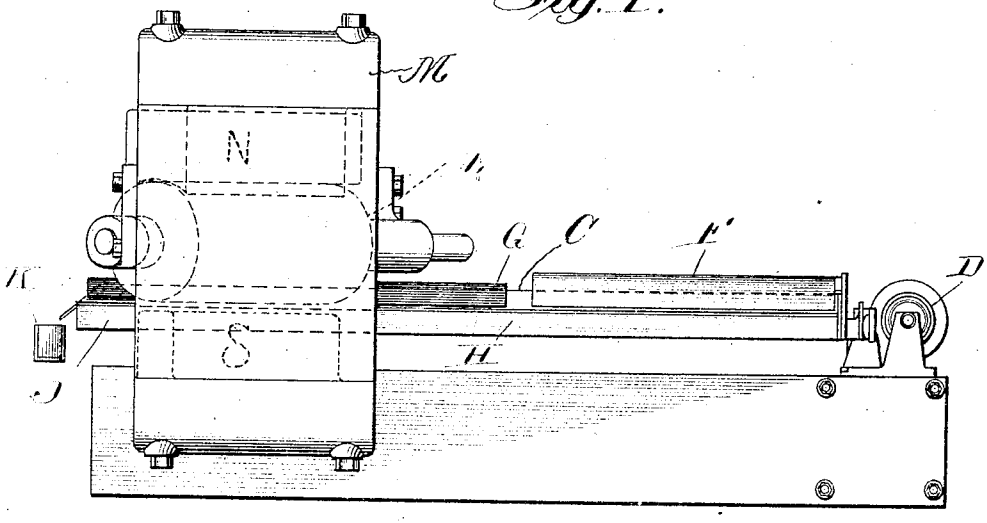

Fig. 2.

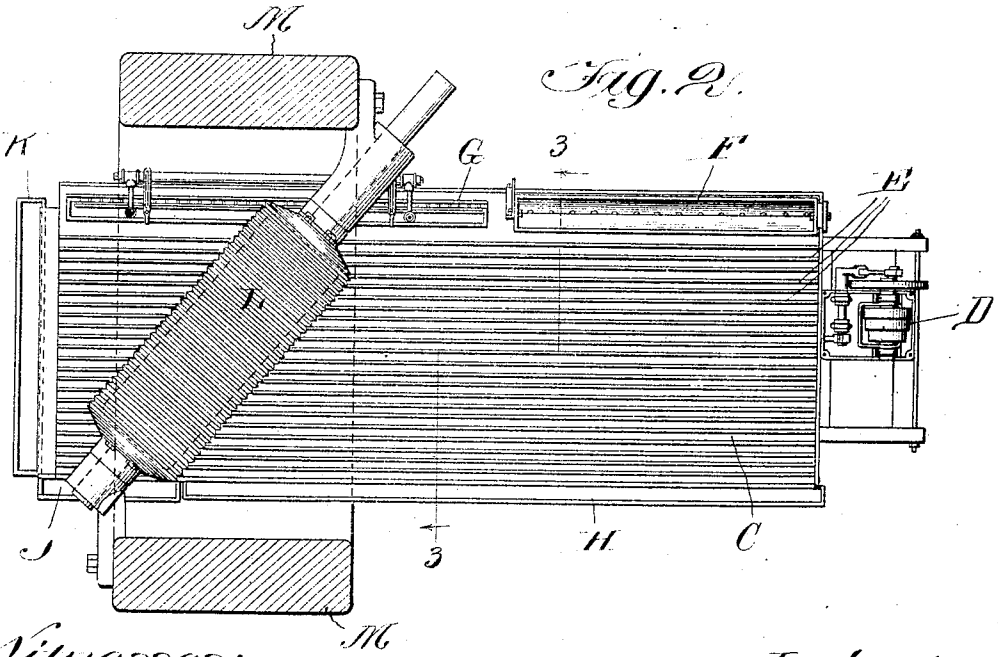

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Fig. 3.

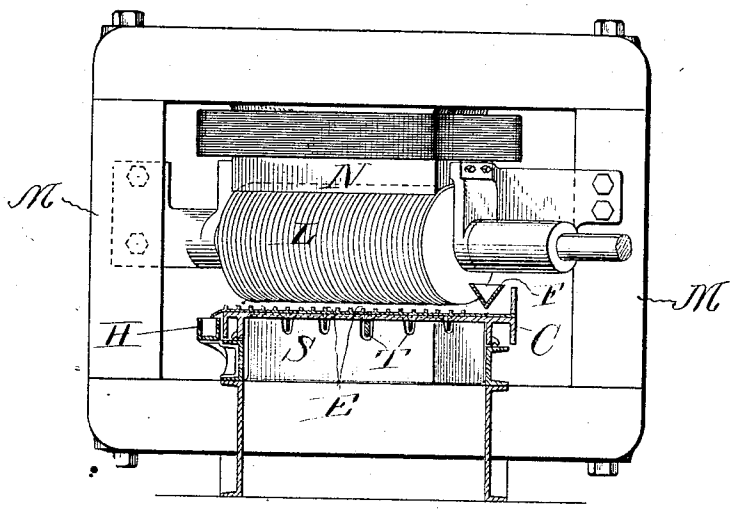
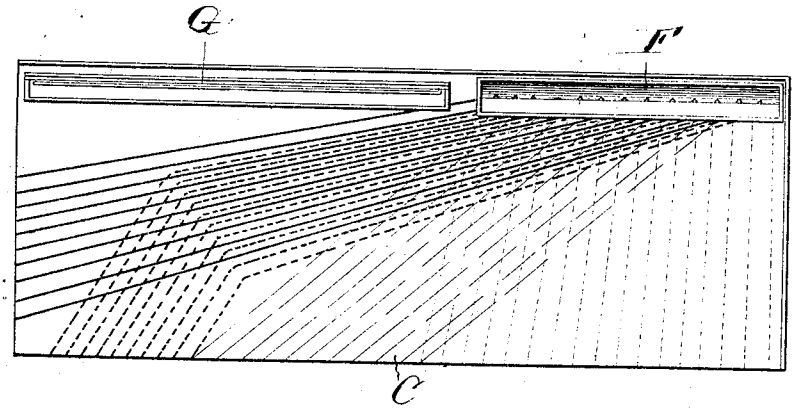


Fig. 4.



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UNITED STATES PATENT OFFICE.

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MAGNETIC ORE-SEPARATOR.

No. 823,234. Specification of Letters Patent. Patented June 12, 1906.

Application filed March 20, 1905. Serial No. 251,071.

To all whom it may concern:

Be it known that I, HENRY H. WAIT, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Magnetic Ore-Separators, of which the following is a full, clear, concise, and exact description.

My invention relates to an ore-concentrator; and its object is to provide improved apparatus for separating magnetically-permeable ores from mixtures containing them, my invention being more particularly intended to be used for the treatment of mixtures of ores or materials which have so nearly the same specific gravity that they could not ordinarily be separated in a satisfactory manner by the usual type of shaking-table separator, which is dependent for its operation upon the different specific gravities of the materials worked upon.

Briefly my invention contemplates the combination, with a shaking-table concentrator, of a magnet, preferably in the form of a rotating cylinder, provided with teeth or means for causing dispersions of the magnetic flux at its periphery, arranged to move close to the surface of the table and at such an angle thereto that the more permeable particles of material upon the table will be attracted by the moving flux divergencies and positively shifted out of their regular gravitational path. By this means the more permeable particles of material are caused to be discharged from the table at a different location from the place of discharge of the other elements of the mixture with which they would otherwise be mingled.

I will describe my invention particularly by reference to the accompanying drawings, in which—

Figure 1 is a view in elevation of an ore-concentrator constructed in accordance with my invention. Fig. 2 is a plan view thereof. Fig. 3 is a transverse sectional elevation on line 3 3 of Fig. 2, and Fig. 4 is a diagrammatic plan view of the table, showing the manner in which the ordinary distribution of the materials thereon is modified by my invention to produce an effective separation of the magnetic particles from the other particles having approximately the same specific gravity.

The same letters of reference indicate the same parts wherever they are shown.

The concentrating-table shown in the drawings, except for the magnet mechanism, is a type well known in the art. The material is intended to be fed to the table C through the feed-box F, (shown in the upper right-hand corner of Fig. 2 and Fig. 4,) from which it is caused to move gradually along the table toward the left-hand end. Such travel of the material is caused by the differential reciprocating or shaking movement of the table produced by the mechanism D of the usual type. Each movement of the table to the left is suddenly checked by the operation of the shaking mechanism, so that a step-by-step progression of the materials is thus caused, this movement being preferably assisted somewhat by a very slight inclination of the table in the same direction. The table is also slightly inclined about its horizontal axis, so that dressing-water fed to the table through the clear-water box G will flow down across the surface of the table in the usual manner toward the tailings-box H. Riffles E E are provided upon the surface of the table, said riffles extending parallel to the direction of reciprocation. It is understood that these riffles may be formed either by raised strips upon the surface of the table or channels therein. A box K is provided at the end of the table to receive the heavy product which is not washed into the tailings-box by the action of the water.

The ordinary operation of such a table is well understood. The materials fed on, mixed with water through the feed-box F, are gradually moved along the table parallel to the riffles E E by the differential reciprocating or shaking motion which is imparted to the table by the mechanism D. At the same time the dressing-water flowing across the table transversely to the riffles carries the lighter material over the tops of the riffles and downward to the lower edge of the table. The heavier material, however, sinks to the bottom and continues its passage along the riffles toward the end of the table. The result is that the lighter materials are separated from those which are heavier, the lighter materials coming off near the forward end of the table in the tailings-box H, while the heavier materials stay on the table until they reach

the lower end, where they are collected in the box K.

In many instances the heavier product will be mixed with magnetic material, which, being of substantially the same weight is not effectively separated. In accordance with my invention I propose to separate the more permeable material by positively shifting the moving particles out of their gravitational path by means of a magnet moving above the table. Preferably the magnetic apparatus is constructed as follows: A field-magnet M is mounted with one pole-piece S underneath the table and the other pole-piece N above the table and a magnetic cylinder mounted to rotate in the field between the pole-pieces N and S, with the surface of said cylinder approaching as closely as practicable to the upper surface of the table. The cylinder is preferably placed at an angle to the riffles or obliquely transverse thereto, as shown in Fig. 2, and is arranged to rotate in a direction such that magnetic particles adhering to the under side of the cylinder will be shifted over the riffles toward the bottom of the table—that is to say, in the general direction of fall of the wash-water. This magnetic cylinder is located near the lower end of the table, so that the lighter products will have been washed off before the mixture reaches the magnet, it being the intention here to simply separate the magnetic particles from the rest of the heavy product.

The magnetic cylinder should be provided with magnetic teeth or ridges or other means for causing dispersions of the magnetic flux at its periphery, so that the magnetic particles on the table will tend to move toward the cylinder instead of toward the pole-piece S, it being understood that the movement of a magnetically-attracted particle is along converging lines of force.

By locating the magnetic cylinder L between the two opposing pole-pieces N and S of opposite polarity neutral points are established upon the surface of the cylinder between the two poles, and in the rotation of the cylinder when the attracted particles reach the neutral point they will tend to drop off.

The arrangement of the magnetic cylinder to rotate between opposed pole-pieces is also advantageous in that the magnetic pull upon the cylinder, which would otherwise be very great, is approximately balanced. The shaking table C can be made in the usual form, except it should be very thin where it passes through the air-gap between the separator-armature L and the pole-piece S. It can be strengthened, however, by the ribs T, which can fall in notches or grooves in the pole-piece S, as indicated in Fig. 3.

In the operation of the table, as indicated in diagram in Fig. 4, the heavier portions of the ore gradually work along in the grooves formed by the riffles toward the farther end of the table. The lighter portion of the ore is usually a waste product and is washed off, as indicated by the very light dotted lines. The path of the intermediate product is indicated by the thin dashed lines. The heavy mineral would follow in a general way the heavy full lines, and the ore having magnetic properties being usually heavier than the silica and other common forms of tailings will work down along the riffles with the other heavy products. It will be seen, therefore, that without my invention a clean concentrate could not be made. With the use of the magnet L, however, the magnetic product can be diverted, as shown by the heavy dotted lines in Fig. 4. This product will at first follow the approximate direction of the heavy mineral; but when it comes underneath the moving armature it will be attracted along the converging lines of force to the surface of said armature, and as the armature rotates it will be shifted positively across the riffles. After being thus picked up by the armature it is dropped therefrom at a point farther across the table toward the bottom. Then in the action of the table, if it is again brought within the influence of the magnet, the shifting will be repeated, so that finally the magnetic product will be separated from the other heavy product and discharged from the table at a different place, so that a clean concentrate is thus obtainable.

I claim—

1. The combination with a shaking-table concentrator, of a magnet having permeable projections arranged to move close to the surface of the table, and at an angle to the direction of reciprocation thereof adapted to cause the more permeable particles to be moved out of their regular path.

2. The combination with a shaking-table concentrator having riffles thereon, of a magnet having means for producing flux divergencies, and means arranged to move said divergencies close to the surface of the table at an angle to said riffles; whereby the more permeable particles of material are shifted across the riffles by said moving flux divergencies.

3. The combination with a shaking-table concentrator, of a magnetic body under the table, and a magnetized cylinder provided with means for causing dispersions of the magnetic flux at its periphery, said cylinder being rotatably mounted above the table obliquely transverse thereto and closely approaching the surface thereof; whereby in the rotation of said cylinder, the more permeable particles of material upon the table are shifted out of their regular gravitational path.

4. In an ore-concentrator, magnet pole-pieces of opposite polarity, and a substantially horizontal magnetic cylinder arranged

to rotate between said pole-pieces, said cylinder having means for causing divergencies of the magnetic flux at its periphery, in combination with a shaking table, means arranged to reciprocate said table between said rotating cylinder and the lower pole-piece at an angle to said cylinder, adapted to cause the more permeable particles to move out of their regular path, substantially as set forth.

5. In an ore-concentrator, the combination with a shaking table, of an armature arranged to revolve above the table, said armature being provided with permeable magnetic projections closely approaching the surface of the table in the rotation of said armature, a pole-piece forming a working magnetic gap with said armature, and means for reciprocating said shaking-table in said gap, said armature being mounted at an angle to the table, and means for rotating said armature to cause the more permeable particles to move out of their regular path.

6. The combination with a shaking-table concentrator, of a rotating magnetic cylinder having teeth on its periphery for causing dispersions of the magnetic flux, said teeth being arranged to move close to the surface of said table and at an angle thereto, means for rotating said cylinder to cause the more permeable particles to be moved out of their regular path, and a field-magnet between the poles whereon said cylinder is mounted.

7. The combination with a shaking-table concentrator, of longitudinal riffles on said table, means for flowing water transversely across the table to remove the lighter material, a magnet having permeable projections arranged to move close to the surface of said table, and at an angle to the table capable of moving the more permeable particles out of their regular path, and means for moving said magnet.

8. The combination with a transversely-inclined shaking-table concentrator having longitudinal riffles thereon, of means for feeding materials to be separated to the table, means for flowing water transversely across the table to remove the lighter material, a rotatable magnetic cylinder arranged to move close to the surface of said table, and at an angle thereto, and means for rotating said cylinder to cause the more permeable particles to be moved out of their regular path.

In witness whereof I hereunto subscribe my name this 13th day of March, A. D. 1905.

HENRY H. WAIT.

Witnesses:

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