No. 832,825. PATENTED OCT. 9, 1906.

H. H. WAIT.

MAGNETIC SEPARATOR.

APPLICATION FILED MAR. 20, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

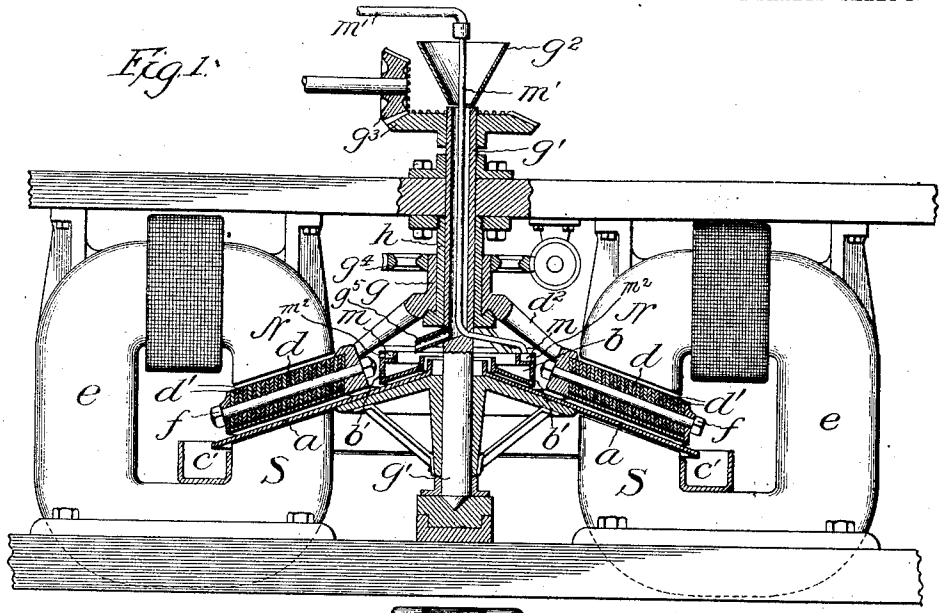


Fig. 2.

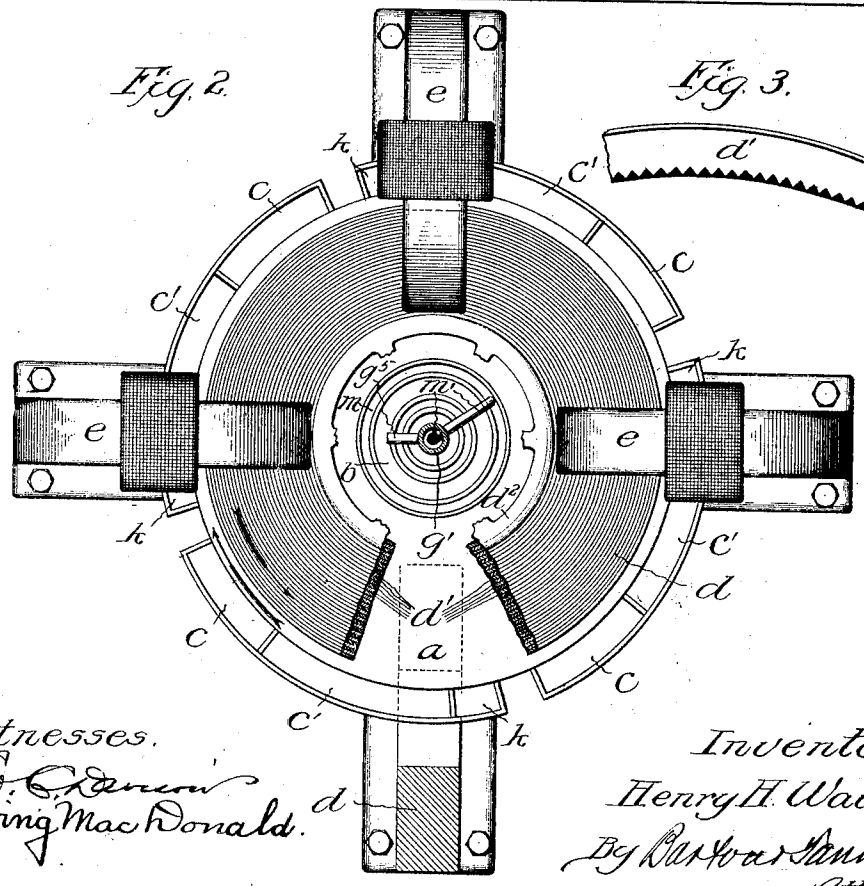


Fig. 3.

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2 SHEETS—SHEET 2.

Fig. 4.

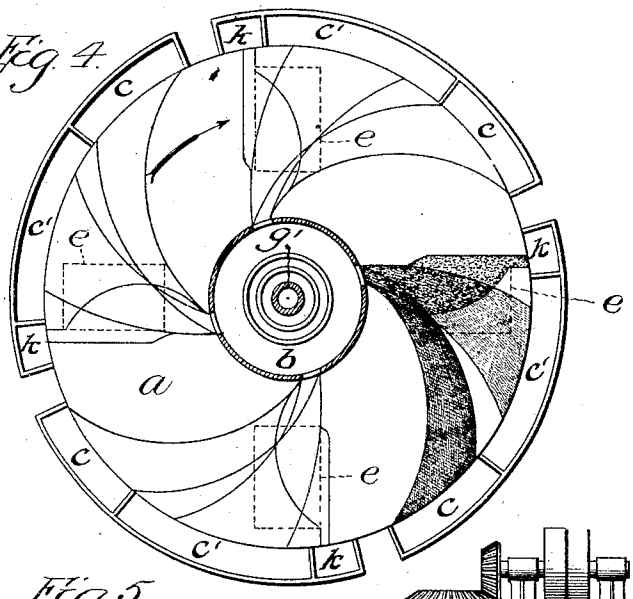


Fig. 5.

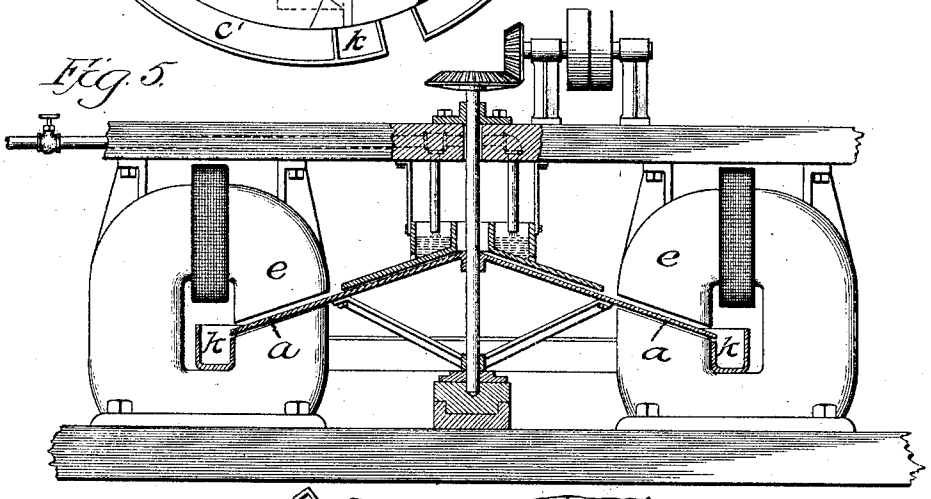
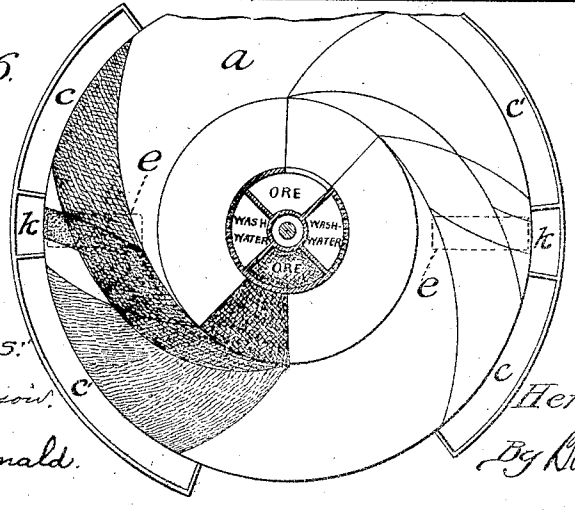


Fig. 6.



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UNITED STATES PATENT OFFICE.

HENRY H. WAIT, OF CHICAGO, ILLINOIS, ASSIGNOR TO INTERNATIONAL SEPARATOR COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF NEW JERSEY.

MAGNETIC SEPARATOR.

No. 832,825. Specification of Letters Patent. Patented Oct. 9, 1906.

Application filed March 20, 1905. Serial No. 251,069.

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 Separators, of which the following is a full, clear, concise, and exact description.

My invention relates to a magnetic ore-separator for the concentration of ores in a wet condition; and its object is to provide improved simple apparatus whereby a mixture of magnetic and non-magnetic materials may be treated in such a way that the magnetic material will be taken out and the remainder of the material classified or concentrated according to its specific gravity, all in the same operation.

The invention relates more particularly to the class of concentrators known as "buddles" and contemplates an improved buddle in which means are provided for concentrating the magnetic material apart from the rest.

I will describe my invention particularly by reference to the accompanying drawings, and the parts, improvements, or combinations which I regard as novel will be pointed out in the appended claims.

In the drawings, Figure 1 is a vertical sectional elevation of my ore-concentrator. Fig. 2 is a plan view thereof with parts broken away. Fig. 3 is a detail view of a circumferential section of one of the laminæ of which the revolving magnet cone or armature is built up. Fig. 4 is a diagram illustrating the disposition of materials in the machine illustrated in Figs. 1 and 2. Fig. 5 is a vertical sectional elevation of a modified form of ore-concentrator somewhat simpler than the form shown in Figs. 1 and 2, and Fig. 6 is a diagrammatic plan view of the machine shown in Fig. 5.

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

Referring first to Figs. 1 and 2, the supporting or feed surface which receives the material to be treated and upon which separation takes place is in the form of a cone *a*, having an annular feed-box *b* at the top, from which the ore mixed with water is fed upon said cone through openings *b' b'*. Boxes *c' c k* are provided at the bottom of the cone for receiving the material washed down. A conical magnetic armature *d* is arranged to rotate immediately above the cone *a* and in close proximity thereto, and magnets *e e* are provided at intervals around the circumference of said armature, with opposing poles N S above said armature and below said cone *a*, respectively, so that the material passing down the surface of the cone will traverse the intense magnetic flux which passes from pole to pole of each magnet through said armature. It is intended that the armature in its rotation shall pick up the more permeable particles of ore or material passing down said conical feed-surface and transfer the same to the extreme edge of the magnetic field established between the poles N S of each magnet, and the armature is therefore provided with means for securing dispersions or divergences of the magnetic lines of force from its under surface. In magnetic attraction the movement of the particles is along converging lines of force. Therefore if the armature is provided with magnetic teeth, ridges, or projections on its under surface the more permeable particles will tend to adhere to said surface and will be carried around in the rotation thereof. In order that the conical armature *d* may be rotated with the least expenditure of energy, said armature is composed of thin laminations subdividing the same vertically or in the direction of the flux between the magnet-poles N and S, so as to prevent eddy-currents. The armature may thus be built up of concentric bands *d'*, of sheet-iron, fastened together by radial bolts *f f*. Fig. 3 shows a portion of one of these bands, which is serrated or toothed along the lower edge. These laminations are preferably assembled in relative positions to present the teeth in staggered rows. It will be seen that this laminated construction lends itself readily to the production of divergences or dispersions of the magnetic flux, not only because of the ease with which a toothed surface may be built up of serrated plates, but also because lines of force naturally tend to diverge from the edges of the individual plates. It is evident that any desired form of teeth, ridges, or permeable projections may be provided, and it is not necessary that the physical surface of the armature should be rough. In

some cases it may be desirable to fill the spaces between the teeth with wax or other non-magnetic material.

The laminated armature *d* is shown as supported upon a spider d^2, having a hollow shaft or stem *g*, rotatably mounted upon a quill *h*, suspended from the upper framework. Said hollow shaft *g* is driven by a worm-gear g^4, as illustrated. Within the quill *h* and rotatably mounted in bearings secured to the upper and lower framework is the hollow driving-shaft *g'*, communicating at the top with the feed-hopper g^2, into which the material to be treated is delivered. The revolving conical table *a* is rigidly mounted upon said shaft *g'* and is driven by a pair of miter-gears g^3. The shaft *g'* is hollow only through a portion of its length or down to a level slightly above the feed-box *b*, and at this point a pipe or spout g^5 is inserted for the purpose of distributing the ore fed through shaft *g'*. Within the shaft *g'* is a small wash-water-supply pipe *m'*, mounted so as to turn with said shaft and discharge into an annular trough *m* at the edge of the feed-box *b*. The trough *m* is drained at convenient intervals through its outer wall, and the wash-water therefrom flows down over the surface of the conical table *a* and serves to wash the material down the table in the usual way. The openings *b' b'*, through which the material is discharged from said feed-box onto the top of the cone, are located in line with the magnet-poles N S, so that the material passing down the surface of the cone will all necessarily pass through the dense magnetic field of one or the other of the magnets *e e* on its way to the bottom.

The cone *a* is preferably arranged to rotate in a direction opposite to that of the laminated armature *d*, so that in its rotation it will concentrate the non-magnetic material according to its specific gravity in the manner of an ordinary buddle.

A separation of the magnetic material from that which is non-magnetic takes place as the mixture traverses the magnetic field. As soon as the material in its passage down the cone reaches the region under the revolving armature *d* and within the field of force of the magnet the more magnetic particles will be picked up by the teeth upon the armature and carried around in the rotation of said armature until it has reached the edge of the magnetic field. As the movement of rotation of the armature continues and the attracted material is borne out of the magnetic field, it is released, and falling again upon the surface of the cone *a* it continues its downward passage, being finally discharged at the lower edge in the box *k*. The non-magnetic material meanwhile has continued to pass directly down instead of being diverted and is discharged in the boxes *c c'*. The lighter slimes are washed down into the box *c'*, while the heavier non-magnetic material remaining on the table for a longer time is finally discharged into the box *c*.

As several of the magnets may be placed around the circumference of the conical table *a*, (four of such magnets being shown in the drawings,) it will be seen that the machine will have a very large capacity.

If desired, a stream of fresh water may be directed upon the table *a* through a series of openings m^2 in the wash-water box *m*, fed by pipe *m'*, as above described, so as to assist in washing the magnetic material into the box *k* after it has passed beyond the magnetic field and has been released from the rotating armature.

The distribution of the material around the edge of the table is indicated in Fig. 4, the magnetic material being collected in the boxes *k k*, while the heavier non-magnetic concentrate is discharged into boxes *c c*, the lighter sands being washed down into boxes *c' c'*.

In Figs. 5 and 6 a modified form of concentrator is illustrated in which there is no rotating armature, but simply stationary magnets *e e*, arranged with opposite pole-pieces above and below the rotating conical table *a* in position to establish a magnetic field angularly disposed with reference to the ordinary path of the heavier non-magnetic material. In this form of machine the non-magnetic material will be classified and concentrated as in the ordinary buddle; but in passing down the table the magnetic material will be brought within the influence of the magnets and deflected thereby into a path different from the remainder of the concentrate. In this case the magnets are not sufficiently strong to actually pick up the magnetic material from the table, but their effect will be simply to change the apparent weight of the magnetic material coming under them in such a way that said magnetic material will act like the lighter sands and be washed off the table in advance of the non-magnetic concentrate, being thus separated therefrom.

Having thus described my invention, I claim as new, and desire to secure by Letters Patent, the following:

1. In a magnetic separator, the combination with an annular table adapted to cause the passage, of material fed centrally thereon, radially toward the outer edge of said table, an annular armature, concentrically laminated, arranged to rotate above said table, said armature having permeable projections on its under surface, and magnets having opposing pole-pieces above and below said table between which pole-pieces said armature is adapted to rotate.

2. In a magnetic separator, the combination with a conical table and means for feeding material to be separated to the upper por-

tion of said table, means for directing the passage of material radially down said table in different directions, a series of magnets having poles adjacent to said table near the respective paths of such material, a conical annular armature arranged to rotate above said table, and means for collecting the material at different points around the lower edge of said table.

3. In a magnetic separator, the combination with an annular armature composed of concentric, radially-superposed laminæ or bands, of a magnet having opposed poles between which said armature is adapted to be relatively rotated, and means for passing material to be separated between the laminated surface of said armature and one of said magnet-poles.

4. In an ore-concentrator, the combination with a rotating conical table and means for feeding material to be separated to the upper part thereof, means for supplying water to said table to wash down the materials, the lighter material being thus discharged from the table at a different point from the heavier material, magnet-poles of opposite polarity arranged above and below said table and a conical annular armature arranged to rotate above said table, between said magnet-poles; whereby the magnetic material is deflected into a path different from the remainder of the concentrate.

5. In a magnetic separator, the combination with a conical table and means for feeding material to be separated to the upper portion of said table, of means for directing the passage of material radially down said table in different directions, a series of magnets having poles adjacent to said table near the respective paths of such material, a conical annular armature above said table, said table and armature being mounted to rotate in opposite directions, and means for collecting the material at different points around the lower edge of the table.

6. In a magnetic separator, the combination with an annular table adapted to cause the passage of material, fed centrally thereon, radially toward the outer edge of said table, of a magnet above said table and an annular armature concentric with the table and arranged to rotate above said table in an air-gap between said magnet and table.

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

HENRY H. WAIT.

Witnesses:
IRVING MACDONALD,
DE WITT C. TANNER.