(No Model.) 2 Sheets—Sheet 1.

C. J. REED.

MAGNETIC ORE SEPARATOR.

No. 572,369. Patented Dec. 1, 1896.

Fig. 1.

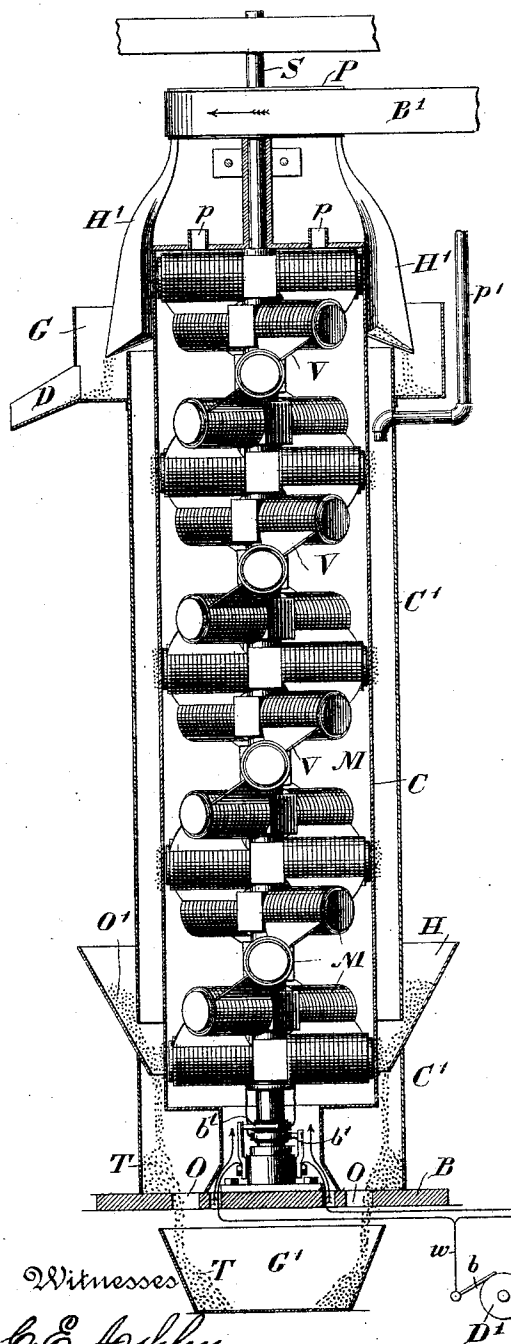
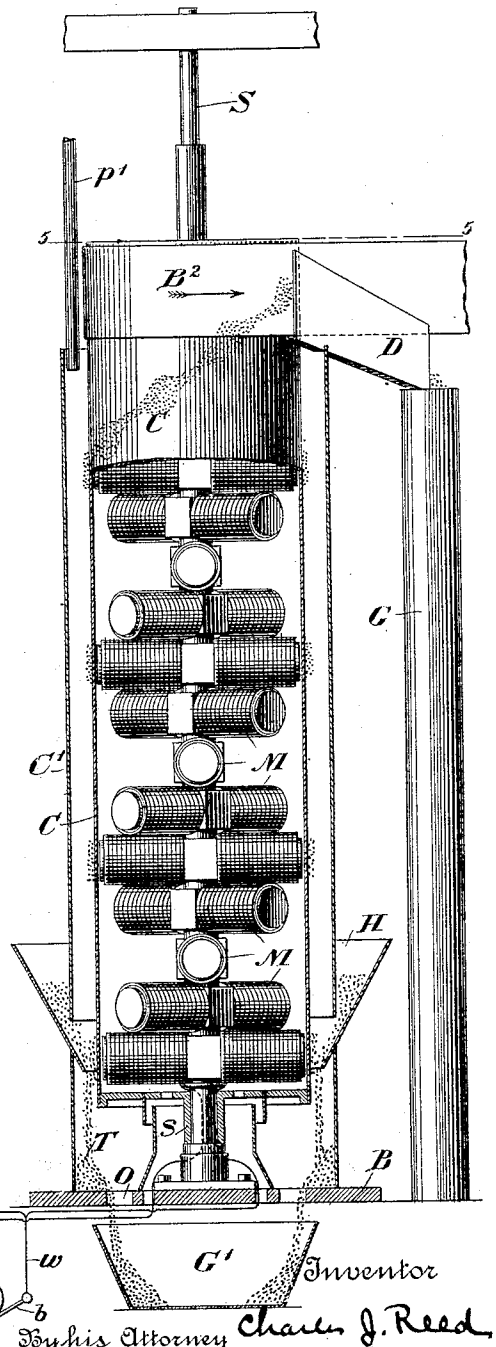


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 4.

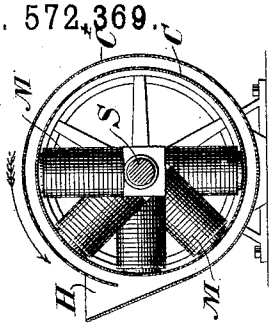


Fig. 3.

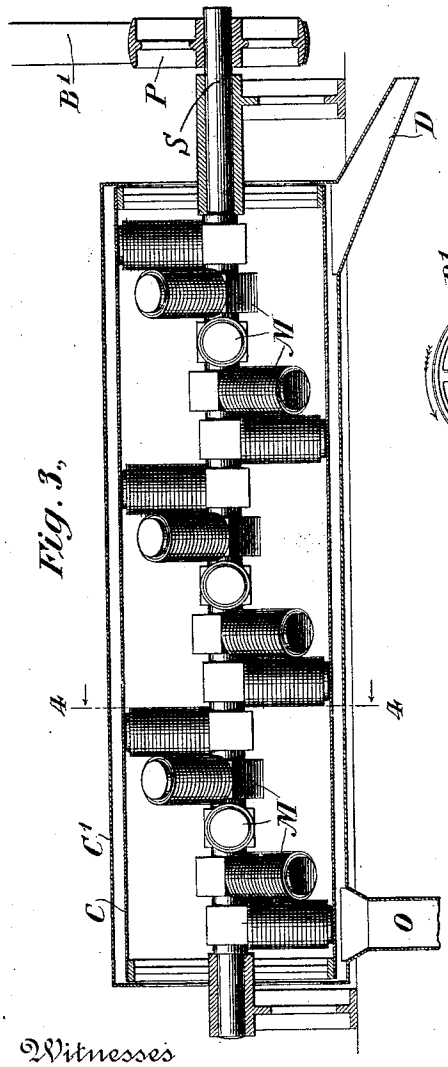
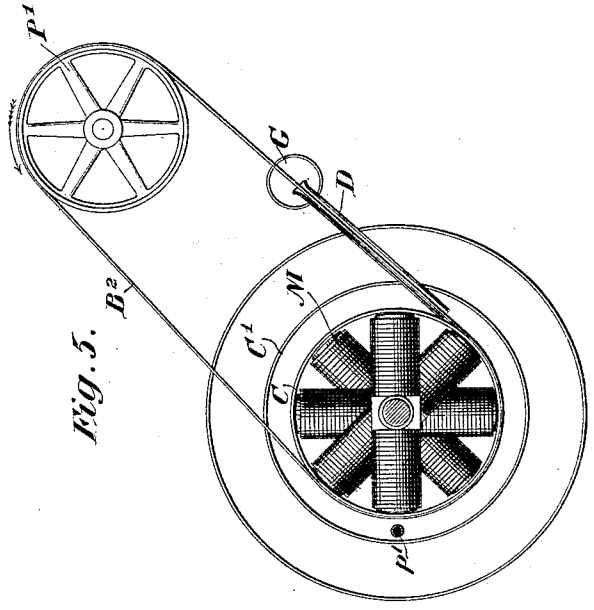


Fig. 5.



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UNITED STATES PATENT OFFICE.

CHARLES J. REED, OF ORANGE, NEW JERSEY.

MAGNETIC ORE-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 572,369, dated December 1, 1896.

Application filed September 3, 1891. Serial No. 404,605. (No model.)

To all whom it may concern:

Be it known that I, CHARLES J. REED, a citizen of the United States, residing at Orange, in the county of Essex and State of New Jersey, have made a new and useful Improvement in Magnetic Ore-Separators, of which the following is a specification.

My invention is directed particularly to improvements upon my inventions disclosed in prior patents, Nos. 466,513 and 466,515, granted to me January 5, 1892, and in order that it may be fully understood reference is had to the accompanying drawings, taken in connection with the following specification, all of the novel features thereof being indicated in the claims which follow.

Figure 1 of the drawings is a longitudinal vertical section of my invention, showing the magnets and their supporting-shaft in elevation. Fig. 2 is a similar view of a modified form of the apparatus. Fig. 3 is a like view of a third modified form; and Fig. 4 is a cross-sectional view taken on line 4 4 through Fig. 3 and as seen looking from right to left in the direction of the arrows. Fig. 5 is a similar cross-sectional view taken through Fig. 2 on line 5 5.

In my prior inventions disclosed in the above-named patents I have described and claimed apparatus for separating magnetic from non-magnetic particles by giving to a mass of such particles a continuous rotary and forward motion in one direction through a magnetic field, which causes the magnetic particles to be moved in a reverse direction, while the tailings pass out in the same direction as that given to the initial powdered ore.

The present application is directed particularly to improved apparatus for accomplishing this result, and in order that it may be fully understood reference is had to the accompanying drawings, in all of which like letters of reference represent like parts wherever used.

Referring first to Fig. 1, B represents the base of the machine, to which is secured an upright cylinder C′, constituting the outer portion thereof, and S is a shaft journaled in the framework of the apparatus at the top and bottom, and carrying a series of permanent or electro magnets M M, arranged in oblique rows, and having, when electromagnets are used, circuit connections with conducting-rings and through contact-brushes b' b' with conductors w w, attached to the brushes b b of a dynamo-machine D′ or other source of electrical energy.

C represents an interior cylinder having its inner surface lying very close to but not in contact with the outer poles of the magnets M, said cylinder in this instance being secured to the frame which sustains the machine and provided at its upper end with air vents or pipes p p. The magnets M M, obliquely arranged, as described, are joined together by a vane V, of metal or any analogous material, the function of this vane being to set up a free circulation of the air within the inner tube or chamber C in the direction of the arrows, as shown at the bottom of the machine, said current ultimately passing out through the outlet-pipes p p.

P is a pulley carried by the shaft S and driven by a belt B′, connected to a source of power with a second pulley P′. (Shown in Fig. 5.)

H′ H′ are scrapers or brushes of shovel form adapted to remove the magnetic particles and deposit them in a receptacle G, having an outlet or chute D.

H is the hopper for feeding the powdered ore into the machine, and G′ the receptacle for the tailings T, O and O being outlets for permitting their egress from the machine into said receptacle.

p' is an inlet-pipe connected either with a blower or a supply of water under pressure (not shown) and adapted to admit either air or water in the space between the cylinders or chambers C C′.

The operation of this form of the apparatus is as follows: The shaft S is caused to rotate in the direction of the arrow at the top of the drawings through the agency of the belt B′ and pulley P, carrying with it the magnets M M and the vane V, the magnets having been energized by the dynamo D′ or other source of electrical energy, as will be understood upon inspection of the drawings. Powdered ore O′ is now fed into the hopper H and allowed to descend around the stationary inner cylinder or chamber C. As the powdered ore passes toward the bottom of the hopper

the lower set or pair of magnets M cause the magnetic particles to be attracted toward their poles and against the exterior surface of the interior cylinder or chamber C and to be carried continuously forward until a sufficient number of them have accumulated to be attracted by the next pair of magnets above. This accumulation continues, and the particles are caused to assume a helical motion by being attracted successively to the spirally-arranged pairs of magnets in succession through the entire series until they reach the top of the apparatus, where the scrapers or brushes H' H', of shovel-like form, attached to the pulley P, cause them to be detached and allow them to drop into the receptacle G, arranged around the upper end of the machine and attached to the exterior chamber C', after which they are removed through the chute D, or the receptacle G may have sufficient slant or pitch to allow them to descend by gravity to an outer receptacle. (Not shown.) The tailings T pass downward through the openings O and are ultimately deposited in a receptacle G'. Owing to the work done by the magnets M in carrying the particles forward and to the heating effect of the current when electromagnets are used they become necessarily more or less heated, and in order to avoid this heating I have provided the vane V, which unites them, in order that as the shaft S rotates a continuous current of air may be put in circulation through the interior of the machine from the bottom thereof, as indicated by the arrows passing outward at the top through the exit-pipes *p p*.

In the modified form shown in Fig. 2 the shaft S and magnets M are stationary, the latter having their coils connected directly to the dynamo by the conductors *w w*, passing out, as shown, through the hollow portion of the fixed shaft S. In this instance the inner cylinder or chamber C is rotated directly by a belt B^2, which serves the double function of rotating it and removing the magnetic particles or concentrates, as will be described. The hopper H and outer cylinder C' have the same relation to the inner cylinder C as in the form shown in Fig. 1, the specific difference lying in the fact that the inner cylinder in Fig. 2 is caused to rotate while the magnets are stationary and in the first instance the magnets are caused to rotate while the cylinder is stationary. The operation of this modified form is not substantially different in principle from that disclosed in Fig. 1, it being understood that as the magnetic particles collect upon the outer surface of the inner cylinder as it rotates around the poles of the stationary magnets M they are ultimately attracted in succession by the obliquely-arranged series of magnets lying one above the other until they are carried over and upon the belt B^2, the forward motion of this belt in the direction of the arrow ultimately causing them to be carried out of the influence of the last pair of magnets and dropped upon the chute or spout D, from which they descend by their own weight into the receptacle G. The function of the pipe *p'*, having an inlet between the inner and outer cylinders C C', is the same as that of the same part in Fig. 1.

In the modified form shown in Fig. 3 the entire machine is horizontally disposed, the magnets M M being arranged in successive oblique rows attached to and carried by the rotary shaft S and propelled by the pulley P and belt B' in the same manner as in Fig. 1, the cylinder C being stationary and the circuit connections to the magnets M M being, through the agency of current-collecting brushes and rings, the same as shown at the bottom of Fig. 1. In this form of the apparatus, however, the powdered ore is fed into a side hopper H, between the cylinders or chambers C C', near the left-hand end of the machine and above the tailings-outlet pipe O. As the particles descend they are attracted by the first magnet M to the outer surface of the stationary inner cylinder C until a sufficient quantity of them accumulates to be placed under the influence of the next succeeding magnet M, and so on continuously until they arrive at the fifth one of the first set. This magnet will continue to collect them on the surface of the cylinder or chamber until they reach such a quantity that they drop off and are acted upon by the first one of the next set diametrically opposite to the last one of the first set, after which they are caused to advance step by step through the influence of this set, and so on through the next succeeding set until they are ultimately dropped into the outlet pipe or chute D.

I do not limit myself to the specific arrangement of magnets herein described and shown for accomplishing the result attained.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. An ore-separator having one or more magnets arranged inside of a hollow cylinder or chamber, in combination with a second surrounding hollow cylinder or chamber through which the ore is advanced longitudinally in one direction, while the tailings are discharged in another direction, substantially as described.

2. In an ore-separator a series of magnets arranged upon a common shaft with their free poles in close proximity to a surrounding cylinder or chamber, in combination with a second outer cylinder or chamber, and outlets at opposite ends of the two cylinders or chambers for the magnetic and non-magnetic particles, substantially as described.

3. In an ore-separator a series of magnets arranged upon a common shaft with their free poles in close proximity to a surrounding cylinder or chamber; a second outer cylinder or chamber; an inlet for feeding the powdered ore against the outer face of the inner chamber; outlets at opposite ends of the two chambers, one for the tailings and the other for the

magnetic particles, and means for removing the latter from the surface of the inner cylinder, substantially as described.

4. In an ore-separator a series of magnets arranged in oblique rows around an axis which supports them all; a surrounding cylinder or chamber lying in close proximity to the free poles of the magnets; a second or outer cylinder or chamber; an inlet for the powdered ore; outlets at opposite ends of the two cylinders for allowing the magnetic particles to pass out at one end, and the non-magnetic particles at the other, substantially as described.

5. A magnetic ore-separator having one or more magnets located inside a hollow cylinder or chamber; a second surrounding cylinder or chamber open at both ends, in combination with a feeding-hopper, and an inlet-pipe for admitting air or water between the two cylinders, substantially as described.

6. A magnetic ore-separator having a series of magnets arranged around a shaft with their free ends in close proximity to a surrounding cylinder or chamber; a second or outer cylinder or chamber open at both ends, and an inlet-pipe for admitting air or water between the two cylinders, substantially as described.

7. A magnetic ore-separator having a series of magnets arranged upon a fixed shaft with their free ends in close proximity to the inner surface of a rotary cylinder or chamber, in combination with a second outer cylinder or chamber open at both ends; means for feeding the powdered ore against the face of the inner cylinder, and means for removing the magnetic particles at one end of said cylinder or chamber, substantially as described.

8. A magnetic ore-separator having a series of magnets arranged obliquely around a shaft one above the other with their free ends in close proximity to a surrounding cylinder or chamber, in combination with means for feeding the powdered ore against the outer face of the inner cylinder, and means for removing the magnetic particles as they are advanced to one end of the cylinder, substantially as described.

9. A magnetic ore-separator having a series of magnets arranged obliquely around and fixed to a shaft, their free poles lying in close proximity to a rotary cylinder or chamber; a second surrounding cylinder or chamber; a feeding-hopper adapted to feed the ore against the outer face of the inner cylinder; means at one end of the cylinder for removing the magnetic particles as they are advanced longitudinally and obliquely, and a receiving device for receiving the particles as they are removed from the cylinder, substantially as described.

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