

No. 731,039.

PATENTED JUNE 16, 1903.

E. GATES.

DIAMAGNETIC SEPARATOR.

APPLICATION FILED MAR. 1, 1900. RENEWED JAN. 13, 1903.

NO MODEL.

Fig. 1.

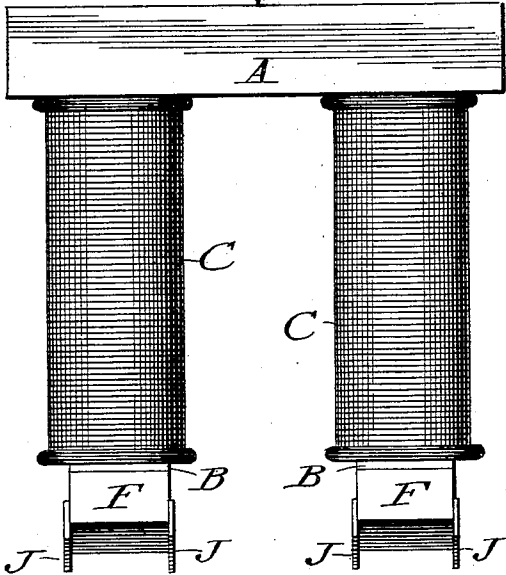


Fig. 2.

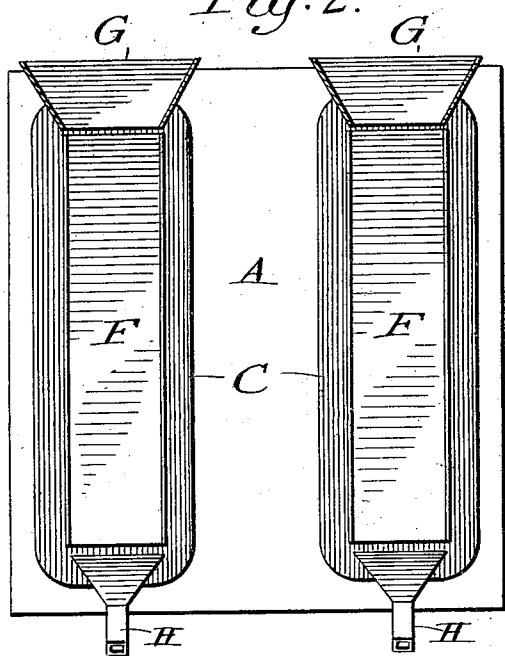
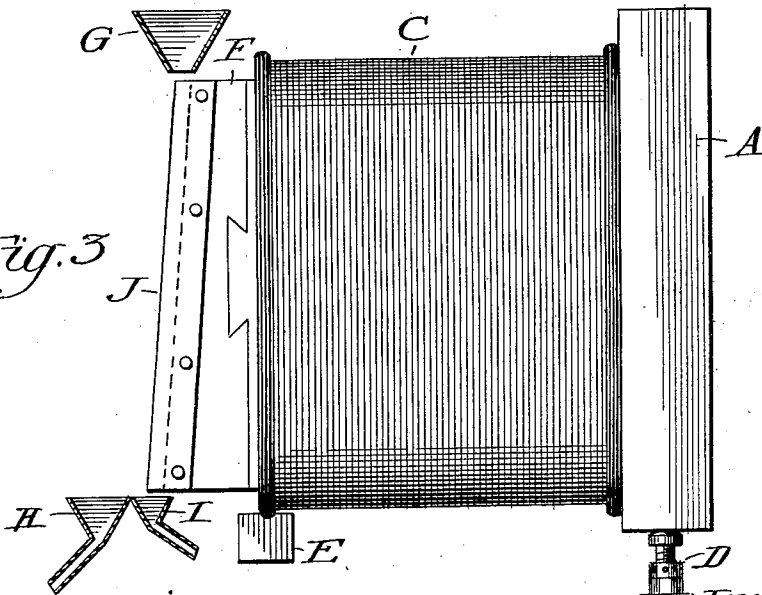


Fig. 3.



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# UNITED STATES PATENT OFFICE.

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## DIAMAGNETIC SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 731,039, dated June 16, 1903.

Application filed March 1, 1900. Renewed January 13, 1903. Serial No. 138,821. (No model.)

*To all whom it may concern:*

Be it known that I, ELMER GATES, a citizen of the United States, residing at Chevy Chase, in the county of Montgomery, State of Maryland, have invented certain new and useful Improvements in Diamagnetic Separators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

In an application for Letters Patent of the United States filed by me September 26, 1899, Serial No. 731,762, I have described and claimed a method for the separation of diamagnetic particles from a mixture containing them or diamagnetic particles of varying susceptibility from each other, said method consisting in feeding the mixture into a relatively intense part of a magnetic field, continuing it in and subjecting it to the action of the magnetic field until the diamagnetic particles to be separated have gradually moved out from the mixture into a relatively weak part of the field, and then collecting said particles separately as heads. In the form of apparatus illustrated in said application as one of the means for carrying out the method referred to the pole-pieces of the electromagnet employed are illustrated as vertically disposed—*i. e.*, so disposed that the magnetic field of force shall occupy a vertical position. In the apparatus illustrated in the present application the pole-pieces are slightly inclined from above downwardly and outwardly, thereby establishing a correspondingly-inclined magnetic field. In consequence of this arrangement the gold or other highly-diamagnetic particles to be separated from the mixture continue within the effective range of the intense part of the magnetic field, their initial tendency to move outward being thus continuously augmented. The inclination of the pole-pieces may be brought about in various ways—as, for instance, by giving them such a shape that they will be inclined when the electromagnet is in a horizontal position or by providing means for tilting the electromagnet as a whole into such position that its pole-pieces will be inclined, or by a combination of these expedients.

In the accompanying drawings, Figure 1 represents a top plan view of an apparatus embodying my invention. Fig. 2 represents a front elevation thereof. Fig. 3 represents a side elevation.

Similar letters of reference indicate similar parts throughout the several views.

Referring to the drawings, A indicates the yoke, B the cores, and C the coils, of an electromagnet suitably energized from a convenient source of current-supply. The cores terminate in pole-pieces which, in the form illustrated, may conveniently be separated at such a distance apart as to provide practically free or independent poles, so that each may be utilized for the diamagnetic separation contemplated. In order to give the poles the desired inclination, the electromagnet may be slightly tilted from the horizontal by means of the adjusting-screw D, which permits the magnet to move upon its rest or fulcrum-block E. In substitution for or in addition to this means for obtaining an inclination of the pole-pieces the pole-pieces themselves may be inclined with respect to the vertical faces of the cores. Thus, as shown in the drawings, pole-pieces F may be provided, fitted to the cores by a dovetail or otherwise and deeper at the bottom than at the top, so as to give an inclination which may be varied with great nicety and accuracy by means of the screw D.

G indicates a feeding-hopper from which the placer-sand or other material containing particles of gold or the like to be separated is fed into the magnetic field.

H indicates the receiving-hopper for the gold or other heads to be separated, and I represents the receiving-hopper for the sand or like tailings. In order to prevent the material from scattering laterally, the pole-pieces may conveniently be provided with cheek-pieces J of brass or other non-magnetic material.

The inclination of the pole-pieces to the vertical should be comparatively slight in order that the separated diamagnetic particles of greater susceptibility—as, for instance, gold—shall not by reason of the countervailing force of gravity be returned to the tailings before receiving a sufficient deflection to permit them to fall into the appropriate hopper.

As the material enters the magnetic field the sand or other tailings of weak diamagnetic susceptibility is practically unaffected by the magnetic lines of force and passes down into the hopper I. During its descent, however, the particles of gold or other diamagnetic material of higher susceptibility move outwardly from the face of the magnet, and since the inclination of the magnetic field is such that it crosses the line of descent of the mixture these particles of greater diamagnetic susceptibility continue within the influence of the intense magnetic field during their further descent and are progressively acted upon by a force of substantially the initial intensity. They are therefore the more effectually and thoroughly driven out from the main body of the falling mass and drop into the receiving-hopper H.

It will of course be understood that the arrangement of receiving-hoppers and feeding-hoppers is the same for each of the magnet-poles, as illustrated, thereby giving the magnet a double capacity of output.

Having thus described my invention, what I claim is—

1. A diamagnetic separator, provided with a pole slightly inclined from the vertical from above downwardly and toward and across the path of gravital descent of the falling particles, in combination with means for feeding the material to be separated onto the upper portion of the pole, and means for receiving the heads and tailings separately at the lower portion thereof, substantially as described.

2. A diamagnetic separator, provided with a pole slightly inclined from the vertical from above downwardly and toward and across the path of gravital descent of the falling particles, in combination with means for feeding the material to be separated onto the upper portion of the pole, means for receiving the heads and tailings separately at the lower portion thereof, and means for adjusting the inclination of the pole, substantially as described.

3. A diamagnetic separator, consisting of an electromagnet provided with two poles

whose cores are united by a common yoke, each of said poles being slightly inclined from the vertical from above downwardly and outwardly, in combination with means for feeding the material to be separated onto the upper portions of the poles, and means for receiving the heads and tailings separately at the lower portions thereof, substantially as described.

4. A diamagnetic separator provided with a pole forming a runway for the material to be separated, said pole being slightly inclined from the vertical from above downwardly and outwardly, a feeding-hopper arranged to feed the material to be separated onto the upper part of the polar runway, and receiving-receptacles for the heads and tailings, respectively, at the bottom of the runway, substantially as described.

5. A diamagnetic separator consisting of an electromagnet having two cores extending in an approximately horizontal direction from a connecting-yoke, means for slightly inclining the poles from the vertical so that their lower ends shall be slightly in advance of their upper ends, hoppers arranged to feed the material onto the poles as runways, receiving-hoppers for the tailings at the bottom of the runways and receivings-hoppers for the heads in advance of the receiving-hoppers for the tailings, substantially as described.

6. A diamagnetic separator, provided with a pole slightly inclined from the vertical from above downwardly and toward and across the path of gravital descent of the falling particles, in combination with means for feeding the material to be separated onto the upper portion of the pole, and a hopper for receiving the heads at the lower portion thereof, said hopper being located on the opposite side of the path of gravital descent of the mass from the pole.

In testimony whereof I affix my signature in presence of two witnesses.

ELMER GATES.

Witnesses:

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J. E. HUTCHINSON, JR.