

E. GATES.

DIAMAGNETIC SEPARATOR.

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

NO MODEL.

2 SHEETS—SHEET 1.

Fig. 1.

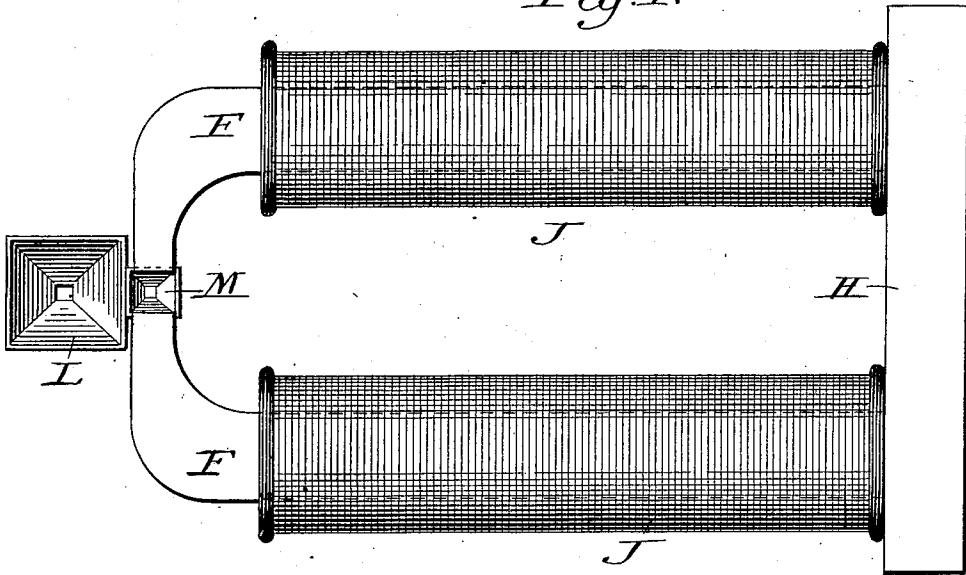
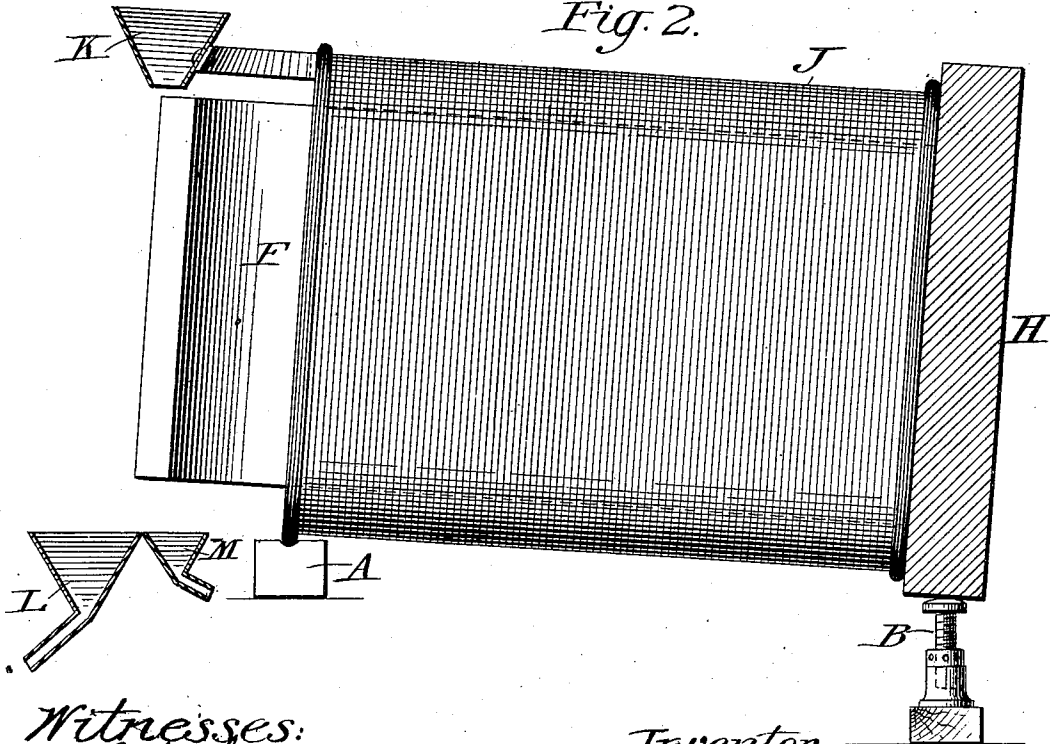


Fig. 2.



Witnesses:
J. E. Hutchinson
C. C. Grant

Inventor,
Elihu Gates,
 by *Samuel Goldsborough*
Atty.

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NO MODEL.

2 SHEETS—SHEET 2.

Fig. 3.

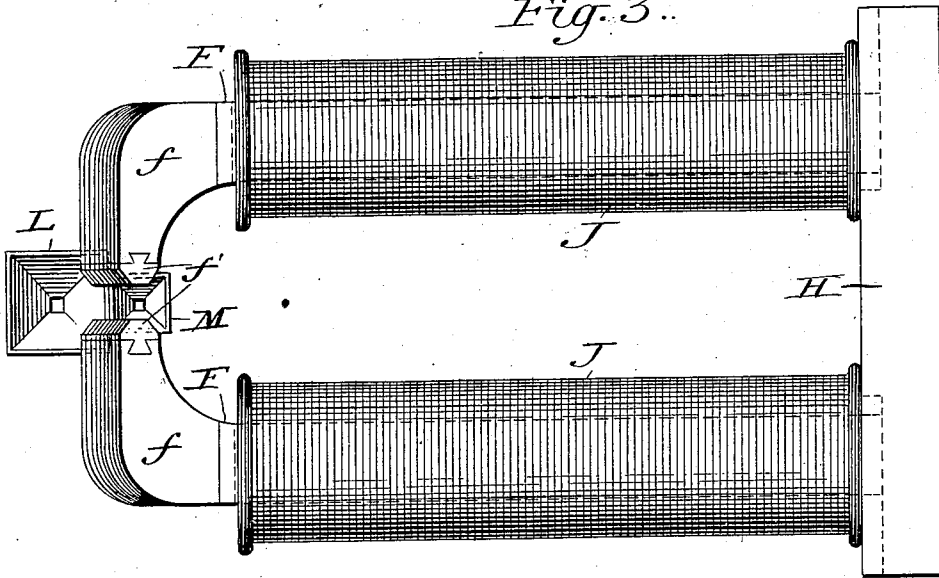
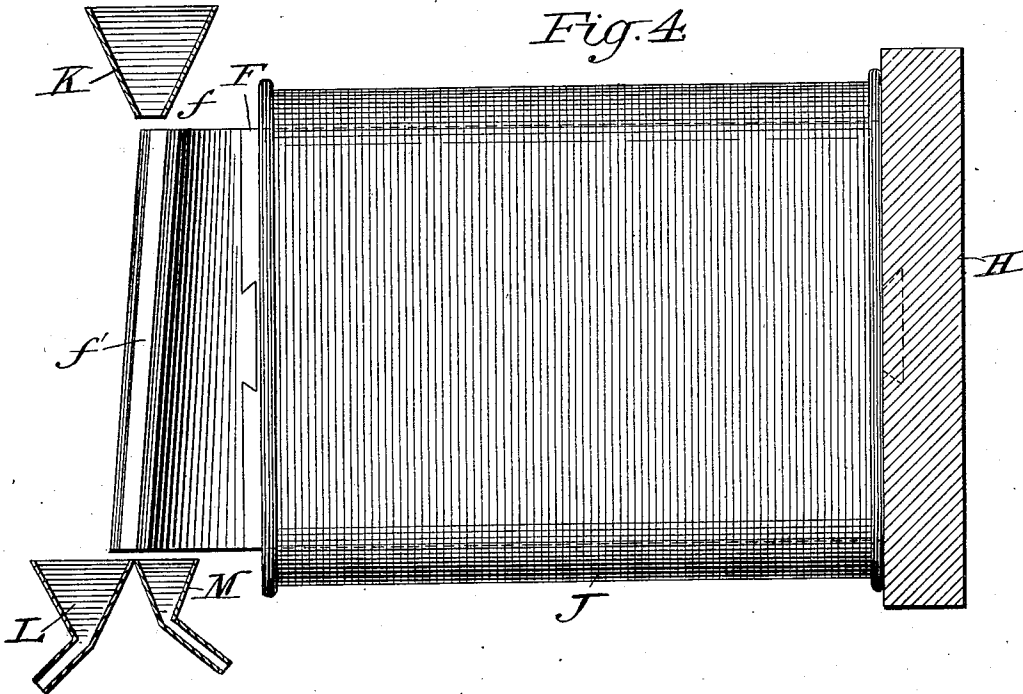


Fig. 4.



Witnesses:

D. W. Edelin.
 J. E. Hutchinson Jr.

Inventor:

Elmer Gates,
 by Lennie Goldborough
 Atty.

UNITED STATES PATENT OFFICE.

ELMER GATES, OF CHEVY CHASE, MARYLAND, ASSIGNOR TO THEODORE J. MAYER, OF WASHINGTON, DISTRICT OF COLUMBIA.

DIAMAGNETIC SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 731,038, dated June 16, 1903.

Application filed March 1, 1900. Renewed January 13, 1903. Serial No. 138,820. (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 of separating diamagnetic particles from a mixture containing them or diamagnetic particles of varying diamagnetic susceptibility from each other by feeding the material into a relatively intense part of a magnetic field and continuing it in the magnetic field until the particles of greater diamagnetic susceptibility shall have moved out from the mass into a relatively weak part of the field, whereupon they are collected separately as heads.

The present invention relates to apparatus adapted for the practice of the method referred to.

In the accompanying drawings, Figure 1 represents a top plan view of one form or modification of such apparatus with the feed-hopper removed. Fig. 2 represents a central longitudinal section thereof with the feed-hopper in place and with the magnet tilted, so as to slightly incline the pole-pieces. Fig. 3 represents a top plan view of another form or modification of the apparatus with the feed-hopper removed. Fig. 4 represents a central longitudinal section thereof with the feed-hopper in place.

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

Referring to the drawings, and particularly to Figs. 1 and 2 thereof, H indicates the yoke, J the energizing-coils, and F the cores, of a powerful electromagnet, said cores diminishing in cross-sectional area at their polar extremities, so as to concentrate the magnetic field across the interpolar space, which is long and narrow, as shown.

In practicing the invention it is preferable,

for reasons set forth in an accompanying application of even date herewith, to slightly incline the magnetic field. This may be accomplished by mounting the forward end of the magnet upon a saddle A, upon which, as a fulcrum, it can be permitted to tilt to the desired inclination by means of the adjusting-screw B. The feed-hopper K is located in such manner with respect to the tapering pole-pieces that it will drop the material to be separated into the magnetic field at a point slightly in advance of the central axis thereof, as indicated in Fig. 2. As a consequence the diamagnetic particles affected by the lines of force move outwardly, ultimately falling into the receiving-hopper L as heads, while the accompanying inert material, such as sand, falls vertically into the hopper M as tailings. The slight inclination given to the magnetic field is accompanied with the advantage that the particles of gold or like material of higher diamagnetic susceptibility receive a continuing increment of their initial deflection, the intense portion of the magnetic field, in effect, following them outwardly as they descend toward the hopper L, and thereby giving them a wider and cleaner separation from the main body of the mass.

In the form of the invention shown in Figs. 3 and 4 the yoke H, the bobbins J, and the cores F are of similar construction and relationship as the corresponding yoke, bobbins, and cores of the form or modification shown in Figs. 1 and 2. In this instance, however, the inclination of the pole-pieces *f* is obtained by making said pole-pieces of an inclined shape. The pole-pieces *f* may, if desired, be made separate from the main body portion of the cores F and may be removably fitted thereto by dovetail joints or otherwise, as shown. Moreover, the said pole-pieces may be given any desired taper by means of wedge-shape ends *f'*, also fitted in dovetail grooves. These end pieces *f'* are made removable, so that others may be substituted for them having different tapers, if desired. It is of course manifest that any alteration in the otherwise permanent inclination of the magnetic field of the apparatus shown in Figs. 3 and 4 may be obtained by providing the magnet with the saddle and adjusting screw of

Figs. 1 and 2. The pole-pieces may be adjusted from or toward each other to narrow or widen the air-gap or the cores F may be similarly adjusted for the same purpose. These adjustments are made possible because of the fact that the cores F are fitted to the yokes H through the instrumentality of dovetail joints and that the pole-pieces *f* are fitted to the cores F in like manner.

It will be noted that the polar faces of the magnetic cores in both forms or modifications of the invention are of the same height as the cores themselves. They therefore establish a uniform magnetic field from top to bottom of the interpolar space, while the great carrying capacity of the yokes and cores permits the formation of highly-concentrated lines of force, peculiarly adapted to the practice of my invention, across the narrow gap.

While I prefer to give the magnetic field the slight inclination illustrated, yet I may give to the magnetic field a vertical adjustment, as indicated in my application, Serial No. 731,762, hereinbefore referred to, in which event the feed and receiving hoppers occupy positions similar to those shown in said application. In fact, so far as I am aware, it is broadly new to effect the separation of diamagnetic substances from a mixture containing them or diamagnetic substances of varying susceptibility from each other by dropping them into a long narrow interpolar space, whether the said interpolar space is vertical or slightly inclined. I desire, therefore, that my invention shall have a correspondingly-broad interpretation.

Having thus described my invention, what I claim is—

1. A diamagnetic separator, comprising an electromagnet having vertically - arranged pole-pieces separated by a long narrow interpolar space, and means for dropping into said space the material to be separated, said pole-pieces being slightly inclined from the vertical transversely to the path of the falling material, substantially as described.

2. A diamagnetic separator, comprising an electromagnet having vertically - arranged pole-pieces separated by a long narrow interpolar space, and means for dropping into said space the material to be separated, said pole-pieces being slightly inclined from the vertical transversely to the path of the falling material, and means for varying the inclination of the pole-pieces, substantially as described.

3. A diamagnetic separator, comprising an electromagnet having vertically - arranged pole-pieces separated from each other by a long narrow interpolar space, said pole-pieces being inclined from the vertical transversely to the path of the falling material, a feed-hopper arranged to discharge the material into the upper portion of the field, and in advance of the center of the upper portion of the field, a tailings-hopper located in rear of the center of the lower portion of the field and below the discharge-chute of the feed-hopper, and a heads-hopper located in front of and proximate to the tailings-hopper; substantially as described.

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

ELMER GATES.

Witnesses:

JOHN C. PENNIE,
J. E. HUTCHINSON, Jr.