No. 731,036. PATENTED JUNE 16, 1903.

E. GATES.

DIAMAGNETIC SEPARATION.

APPLICATION FILED MAR. 1, 1900.

NO MODEL.

Fig. 1

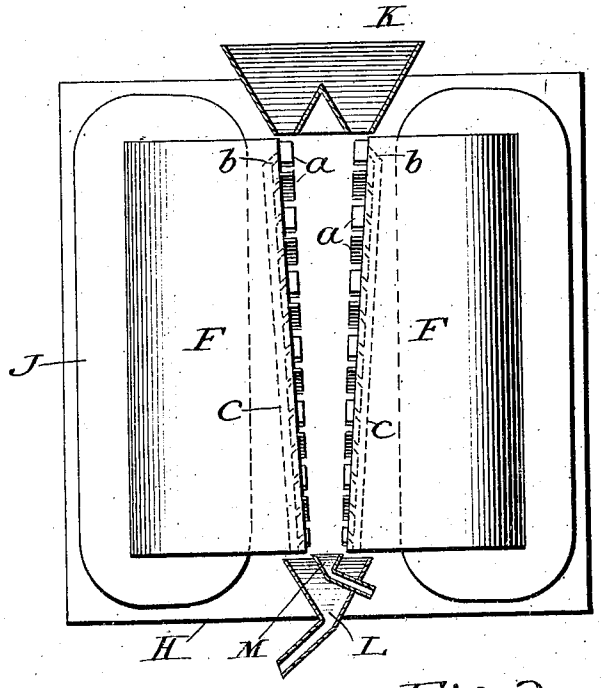
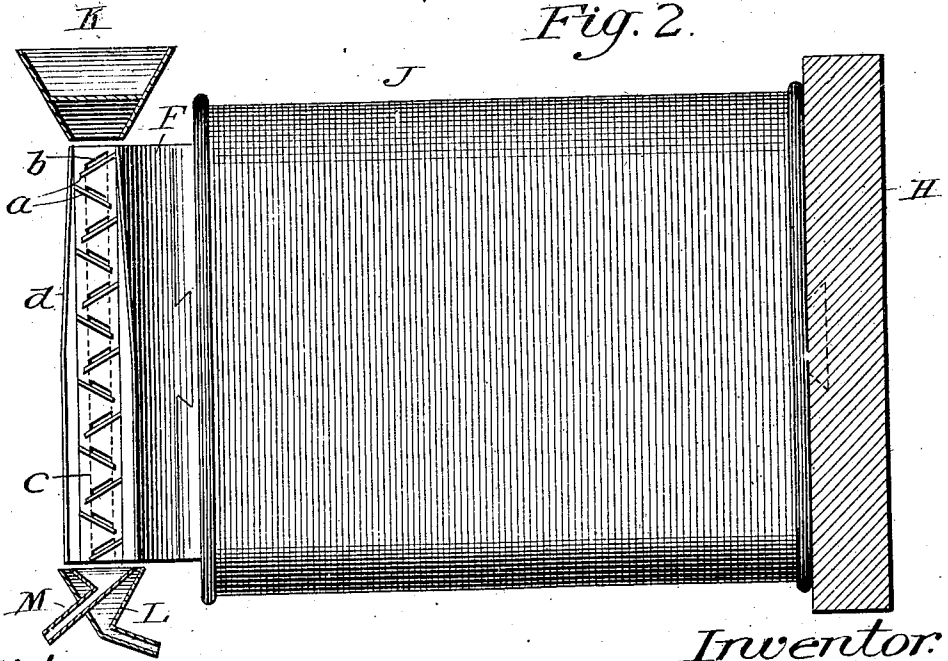



Fig. 2.




Witnesses:
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No. 731,036. Patented June 16, 1903.

# UNITED STATES PATENT OFFICE.

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

## DIAMAGNETIC SEPARATION.

SPECIFICATION forming part of Letters Patent No. 731,036, dated June 16, 1903.

Application filed March 1, 1900. Serial No. 6,948. (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 and State of Maryland, have invented certain new and useful Improvements in Diamagnetic Separation; 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 substances from mixtures containing them or diamagnetic substances of varying susceptibility from each other by feeding the mixture into a relatively intense part of a magnetic field and 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.

My present invention is founded upon the discovery that when the mixture is fed into the field so as to drop immediately adjacent to the pole-faces the diamagnetic particles of greater susceptibility will move toward the center of the interpolar space and may be collected by a hopper located immediately below the center of said space, while the remainder of the mixture may be collected in a separate hopper or hoppers.

In the accompanying drawings, Figure 1 represents a front elevation of one form of apparatus adapted for the practice of my invention. Fig. 2 represents a central vertical section thereof.

Similar letters of reference indicate similar parts in both views.

Referring to the drawings, H indicates the yoke, F the core, and J the energizing-bobbins of an electromagnet, whose pole-pieces face each other, so as to leave an interpolar space, as shown. Below the central vertical line of this interpolar space is located a receiving-hopper M, inclosed by an outlying receiving-hopper L, said hoppers having separate outlet-chutes, as shown.

The poles of the magnet preferably incline toward each other from above downward for a purpose presently to be described, and they are also preferably provided with a series of inclined planes *a*, of brass or other non-magnetic material, whose function is to retard the falling material during its descent. I also preferably provide each pole-piece with a series of inclined recesses *b*, communicating with a common channel *c*, adapted to discharge into the hopper L.

It will be noted that the feeding-hopper K has two discharge-openings and that these discharge-openings are located, respectively, in such manner as to feed the material into the magnetic field at points immediately adjacent to the faces of the pole-pieces. The material thus received passes down the series of inclines *a*, and the sand or other diamagnetic material of very low diamagnetic susceptibility remains practically unaffected by the magnetic field, whereas the gold or other particles of higher diamagnetic susceptibility move outwardly toward the central zone of lesser magnetic intensity of the interpolar space and drop off laterally from the edges of the inclines in their endeavor to reach said neutral axis. Inasmuch as the magnetic field becomes more and more concentrated toward the bottom of the interpolar space, the effect upon the gold particles becomes correspondingly augmented as they descend until they are finally brought within the range of the receiving central hopper M. During this movement of descent part of the accompanying sand, which remains closely adjacent to the pole-faces, passes gradually into the channels *c* through the inclined apertures or recesses *b*, so that the gold becomes continuously more and more disembarrassed of accompanying sand from one incline to the other in the series, said sand being finally received in the hopper L. In order to prevent the material from scattering during its descent, I may conveniently provide the pole-pieces with side strips or flanges of non-metallic material *d*, as shown in Fig. 2.

So far as I am aware it is broadly new in diamagnetic separation to feed the material

into the interpolar space at points immediately adjacent to the pole-faces and to collect the gold or other particles of higher diamagnetic susceptibility from the zone midway of the interpolar space. I desire, therefore, that my claim to this fundamental feature may have a correspondingly generic interpretation.

Having thus described my invention, what I claim is—

1. The method of separating diamagnetic particles from a mixture containing them, which consists in feeding the mixture into a magnetic field having a central zone of lesser magnetic intensity than that into which the mixture is fed, continuing it in and subjecting it to the action of the field until the diamagnetic particles to be separated have gradually moved out from the mixture toward said central zone of lesser magnetic intensity, and then collecting said particles separately as heads; substantially as described.

2. The method of separating diamagnetic particles from a mixture containing them, which consists in feeding the mixture into a magnetic field having a central zone of lesser magnetic intensity than that into which the mixture is fed, concentrating the field from the point of entry of the material onward, continuing the material in and subjecting it to the action of the field until the diamagnetic particles to be separated have gradually moved out from the mixture toward said central zone of lesser magnetic intensity, and then collecting said particles separately as heads; substantially as described.

3. The method of separating diamagnetic particles from a mixture containing them, which consists in feeding the mixture into a magnetic field having a central zone of lesser magnetic intensity than that into which the mixture is fed, continuing it in and subjecting it to the action of the field until the diamagnetic particles to be separated have gradually moved out from the mixture toward said central zone of lesser magnetic intensity, progressively withdrawing the spent inert material during the descent of the mass, and finally collecting the diamagnetic particles of higher susceptibility separately as heads; substantially as described.

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

ELMER GATES.

Witnesses:
JOHN C. PENNIE,
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