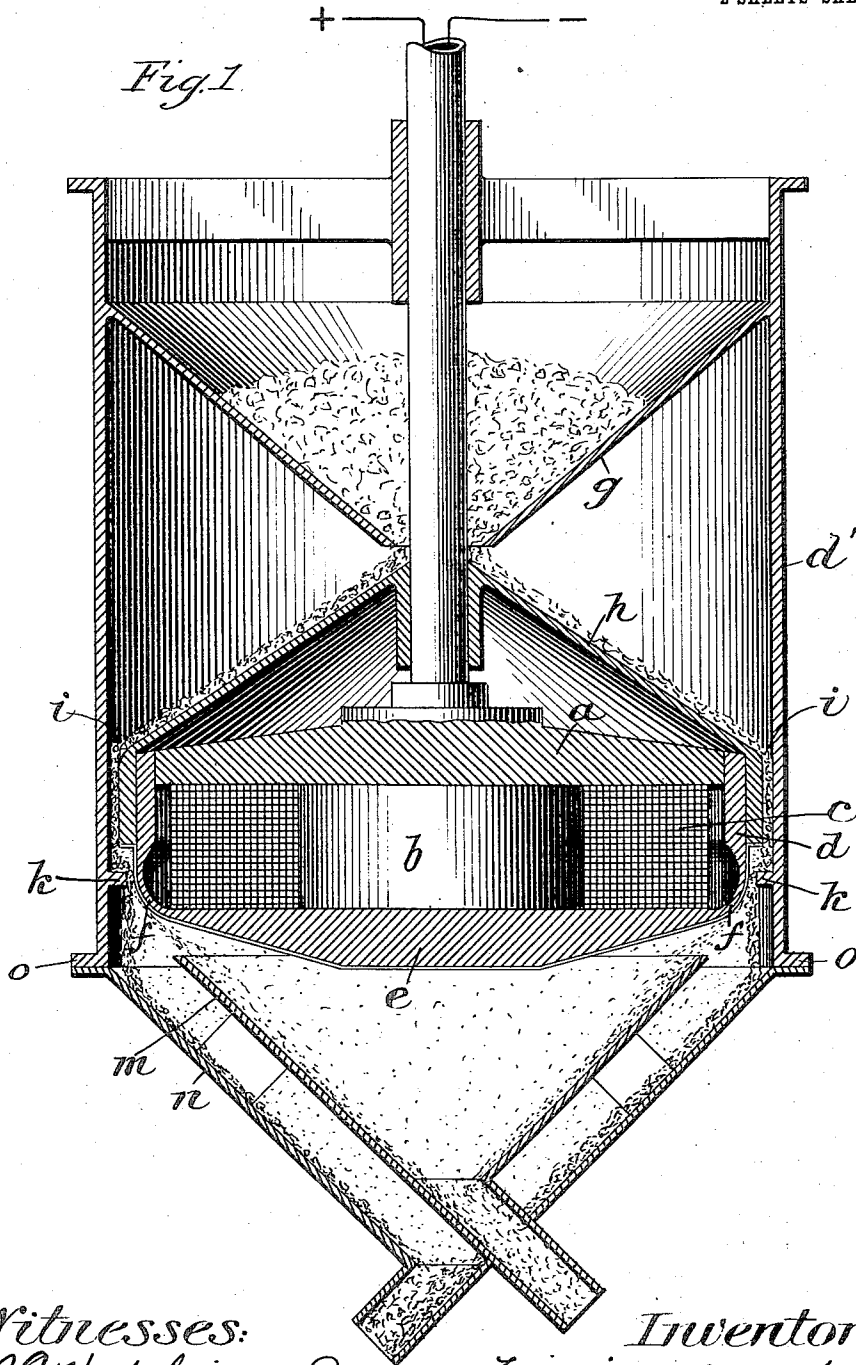


F. O. SCHNELLE.
MAGNETIC SEPARATOR.
APPLICATION FILED OCT. 9, 1902.

971,692.

Patented Oct. 4, 1910.

2 SHEETS—SHEET 1.



Witnesses:

J. E. Hutchinson Jr.
J. M. Warren

Inventor:

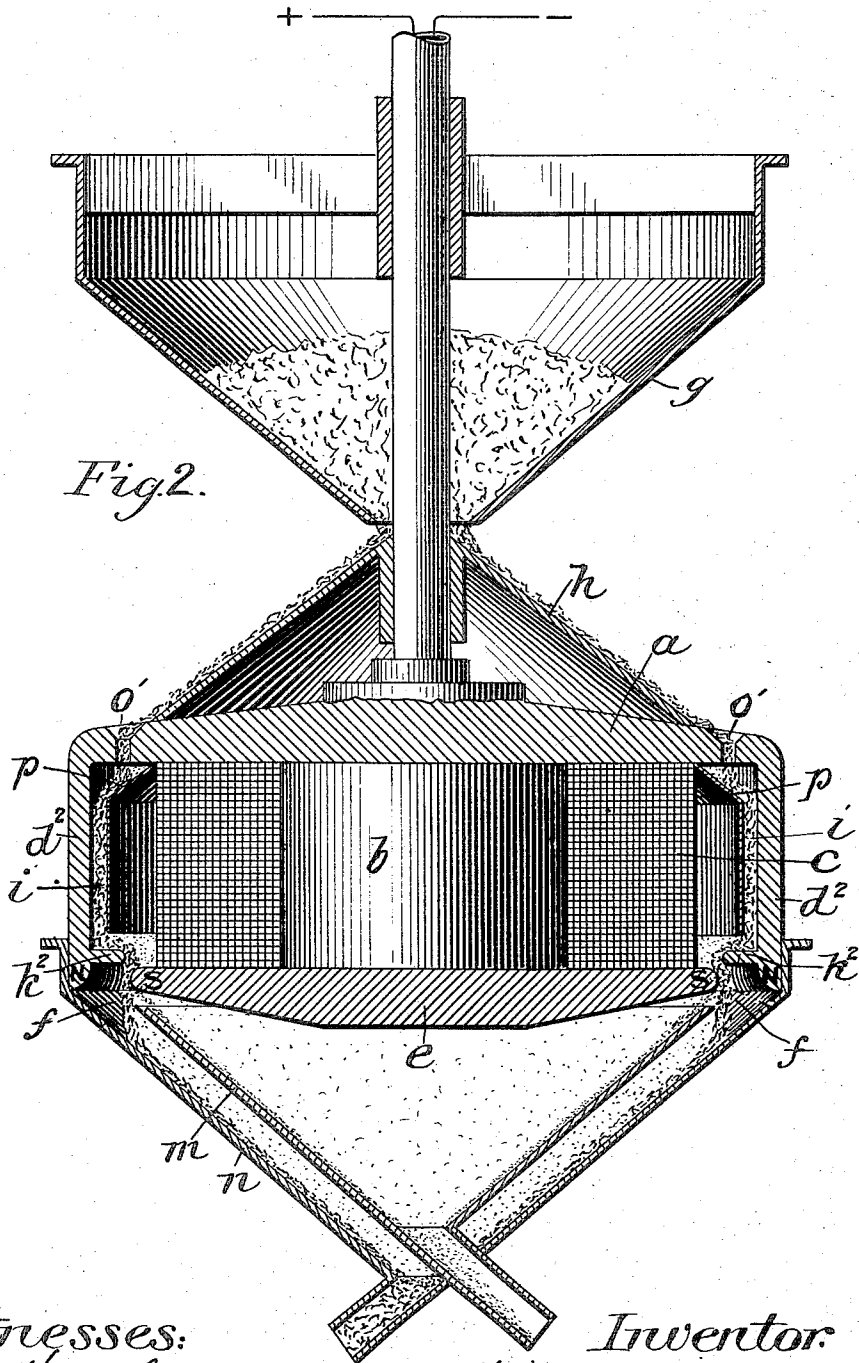
Friedrich Oscar Schnelle,
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UNITED STATES PATENT OFFICE.

FRIEDRICH OSCAR SCHNELLE, OF FRANKFORT-ON-THE-MAIN, GERMANY, ASSIGNOR
TO WETHERILL SEPARATING COMPANY, OF NEW YORK, N. Y., A CORPORATION OF
NEW JERSEY.

MAGNETIC SEPARATOR.

971,692.

Specification of Letters Patent.

Patented Oct. 4, 1910.

Application filed October 9, 1902. Serial No. 126,618.

To all whom it may concern:

Be it known that I, FRIEDRICH OSCAR SCHNELLE, a subject of the Emperor of Germany, residing at Frankfort-on-the-Main, Germany, have invented certain new and useful Improvements in Magnetic 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.

My invention relates to improvements in magnetic separators characterized by the absence of mechanically moving parts, the action of the apparatus according to this invention being solely dependent upon the forces of gravity and magnetic attraction acting directly upon the material to be treated.

In the accompanying drawings: Figure 1 is a sectional elevation of one form of the improved separator, employing one type of iron-clad magnet; Fig. 2 is a similar view of a modified form of separator, employing another type of iron-clad magnet.

One form in which the present invention may be carried into effect and which has been tested in practical operation is shown in the annexed drawings, Fig. 1, representing a vertical central section through the complete separator and Fig. 2 representing a similar section through a modified form of the same.

a is an ironclad ring magnet of the so-called "unipolar" type, its core b is surrounded by the exciting coil c . At the rounded off corner f between the outer ring d and the bottom plate e the iron covering surrounding the coil shows a considerable contraction or attenuation to a thin shell by which the magnetic lines of force are caused to disperse into the surrounding air space and to form a "bulging" field around the pole-isthmus. By this means a magnetic field of attraction is formed along this portion of the magnet, having uniform intensity around the whole circumference of the magnet, but gradually decreasing in intensity in the direction of the flow of the material as will be explained.

g is a conical hopper for receiving the material to be treated, h is a distributing cone preferably of non-magnetic material, covering the magnet and passing downward around the outer ring d of the said magnet.

From the hopper g a tubular shell d' inclosing the whole apparatus projects downward around the magnet, leaving an annular air space i for the passage of the material around the magnet. This outer shell has an inwardly projecting ring k and a bottom flange o . To the latter the two concentric funnel-shaped receptacles m and n are fastened by bolts or otherwise. The lower part of the magnet around the pole-isthmus is preferably covered by means of shell of non-magnetic material, an enamel coating or the like to facilitate the smooth gliding of the material around this part of the magnet. The coating referred to also has the function of equalizing the magnetic potential around the highly concentrated field zone. This covering or coating is substantially integral with the rounded edge of the annular pole and has the following additional function, to wit; the pole being stationary, there is liability of incomplete distribution of magnetization potential, because of differences in the iron itself at different places (due to small variations in chemical composition, internal strain, etc.) but, where a shell of non-magnetic material is applied to the surface substantially integrally therewith, this difference in magnetization potential distribution is substantially equalized all around the edge so as to give it at all points the same separating effect.

The process according to which the separation takes place is as follows: The material contained in the feed hopper g flows over the distributing cone h and is thereby spread out into a thin even film of uniform thickness around the whole circumference. Through the gap i the material drops on to the ring k serving to break the velocity of the falling material and to bring it closely into the active field of the magnet. At the point where the material leaves the ring k the non-magnetic particles fall in approximately perpendicular lines and are collected into the outer receiving hopper n , while the magnetic material following the profile of the polar surface glides through the field and drops into the inner receiver m as indicated in the drawing.

Another application of the principle involved in the apparatus above described is illustrated by the drawing Fig. 2, again showing a central vertical section through a complete separator. The mechanical ar-

rangement of the feed hopper, distributing cone and receiving receptacles is here essentially the same as in Fig. 1, the corresponding parts are designated by the same letters.

5 The pole arrangement of the magnet, however, differs from the above described isthmus-connected poles, by having two separate annular poles N and S, approximately concentric with each other and separated by the
10 annular air space *f*. Through this field gap the material to be separated is fed and separated in the following manner:

The material contained in the hopper *g* flows over the distributing cone *h* and passes
15 through the circular row of holes *o'* into the interior of the iron casing *d*² of the magnet; here it falls on to the conical surface *p*, thence through the narrow gap *i* upon the horizontal ring *k*² serving to feed the material on to the edge of the inner pole S. In
20 gliding off this pole the mixed materials separate near the turning point of the pole curve, the non-magnetic particles being thrown off directly are caught by the exterior receiving hopper *n*, while the magnetic
25 materials following the rounded profile of the pole are deflected into the interior receptacles *m*. In this instance the inner pole S is used for the separation proper while the
30 outer pole N serves only for completing the magnetic circuit.

The invention in its entirety is not confined to the two special forms of iron-clad unipolar ring magnets represented by the
35 drawings.

The essential feature of the invention is the application of this general type of magnets to the automatic separating process illustrated by the two given examples. Thus, it
40 is immaterial in what part of the iron shell surrounding the exciting spool the magnetic field is formed, whether it be at the upper or lower side of the magnet, at the outer circumference or the inner core. It is also im-
45 material whether one or more fields are formed in one and the same magnetic system. The same is true of the different pole forms and field arrangements.

Having now fully described the nature of
50 this invention I claim the following:

1. In a magnetic separator, the combination with a stationary iron-clad ring magnet having in its magnetic circuit a zone of emergence of magnetic flux, means for dropping
55 the material to be separated through said emerging flux, and a heads receptacle whose separating edge is located within the said zone, whereby the tailings or non-magnetic material will fall through the emerging
60 flux and the heads or magnetic material will be drawn inwardly past the said separating edge; substantially as and for the purposes described.

2. In a magnetic separator, the combination with a stationary iron-clad ring magnet,

having in its magnetic circuit a zone of emergence of magnetic flux, means for dropping the material to be separated through said emerging flux, said means including a ledge over which the material falls as it enters the flux, and a heads receptacle whose separating edge is located within the said zone of emergence; substantially as and for the purposes described.

3. In a magnetic separator, the combination with a stationary iron-clad ring magnet, having in its magnetic circuit a zone of emergence of magnetic flux, and means for feeding the material to be separated to said zone, said means including a distributing
80 cone located immediately above the magnet, and a feeding cone discharging upon the upper portion of the distributing cone; substantially as and for the purposes described.

4. In a magnetic separator, an iron-clad
85 ring magnet having an attenuated zone of magnetic material forming an isthmus between the poles, and means for feeding the material to be separated to said attenuated zone; substantially as and for the purposes
90 specified.

5. In a magnetic separator, an iron-clad magnet having an attenuated zone of magnetic material forming an isthmus between the poles gradually decreasing in the direction of flow of the material to be treated,
95 and means for feeding said material to said zone; substantially as and for the purposes described.

6. In a magnetic separator, an annular
100 iron-clad magnet having an attenuated zone of magnetic material causing an annular field of dispersion, means for feeding the materials through said field, an abutment for diverting the material laterally into said
105 field, and compartments for the heads and tailings; substantially as described.

7. In a magnetic separator, an annular iron-clad magnet having an attenuated zone of magnetic material causing an annular
110 field of dispersion, a distributing cone for feeding the material around the periphery of said magnet, an annular abutment for diverting the material laterally into said field, and compartments for the heads and tail-
115 ings, substantially as described.

8. In a magnetic separator, an annular iron-clad magnet having an attenuated zone of magnetic material causing an annular field of dispersion, a hopper containing the
120 material, a distributing cone below said hopper for feeding the material around the periphery of said magnet, an annular abutment for diverting the material laterally into said field, and compartments for the heads
125 and tailings, substantially as described.

9. In a magnetic separator, an annular iron-clad magnet having an attenuated annular zone of magnetic material causing an external field of dispersion, a hopper con-
130

5 taining the material, a distributing cone below said hopper for feeding the material around the periphery of said magnet, an annular abutment for diverting the material laterally into said field, and compartments for the heads and tailings, substantially as described.

10 10. In a magnetic separator, a stationary magnet having an annular pole provided with a rounded edge covered substantially integrally with a smooth shell of non-magnetic material applied to the surface of said rounded edge to equalize the magnetic po-

tential and to facilitate the passage of the non-magnetic particles around said edge, 15 means for causing a peripheral field of dispersion concentric with said edge, and means for feeding the material to be separated into said peripheral field and into contact with the said shell; substantially as described. 20

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

FRIEDRICH OSCAR SCHNELLE.

Witnesses:

JEAN GRUND,
CARL GRUND.