

No. 686,402.

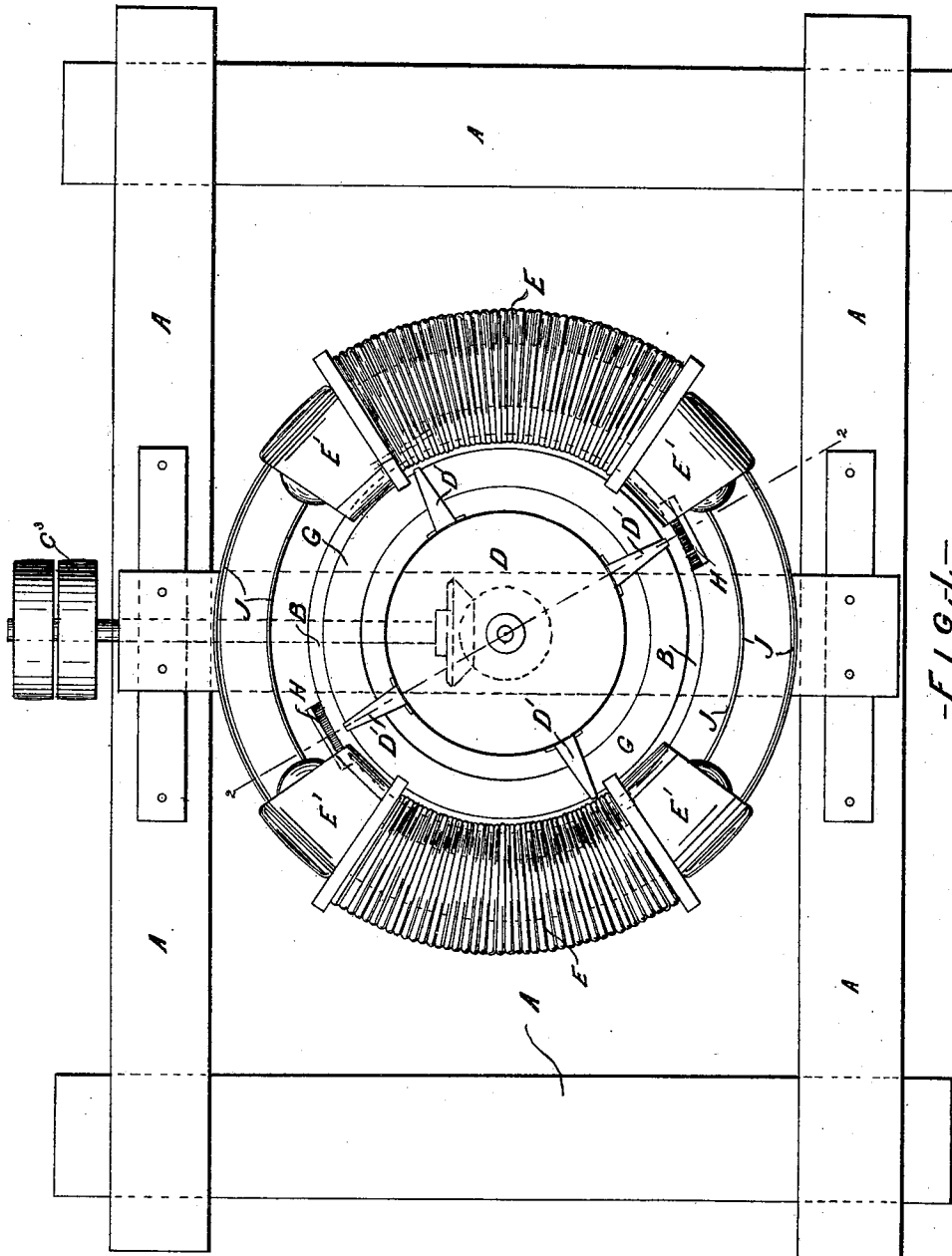
Patented Nov. 12, 1901.

T. J. GREENWAY.
MAGNETIC SEPARATOR.

(Application filed Oct. 12, 1899.)

(No Model.)

5 Sheets—Sheet 1.



-FIG. 1-

Witnesses:
Attest:
B. L. Sommers

Inventor:
Thomas John Greenway
by *[Signature]*

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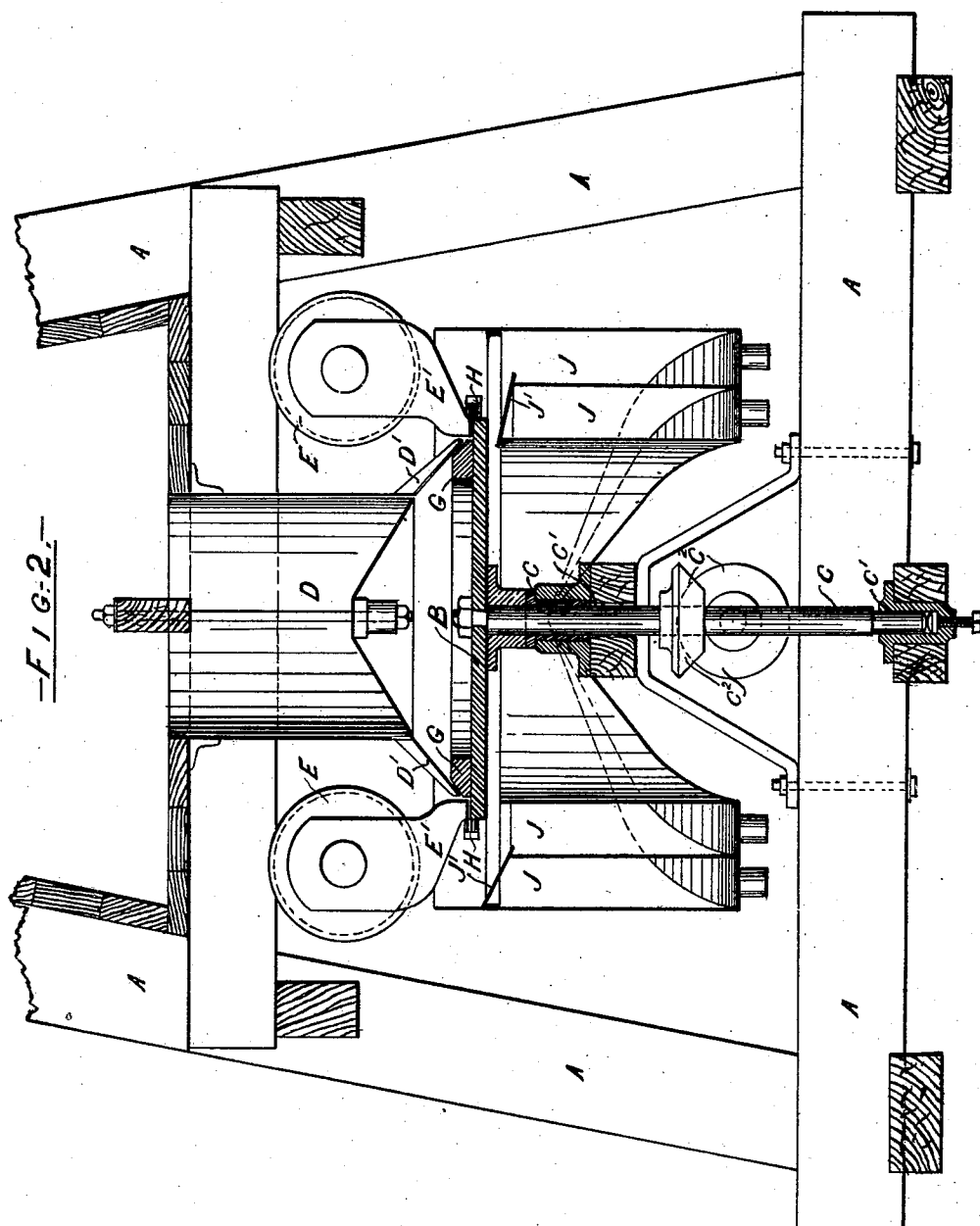
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(Application filed Oct. 12, 1899.)

(No Model.)

5 Sheets—Sheet 2.



Witnessed:
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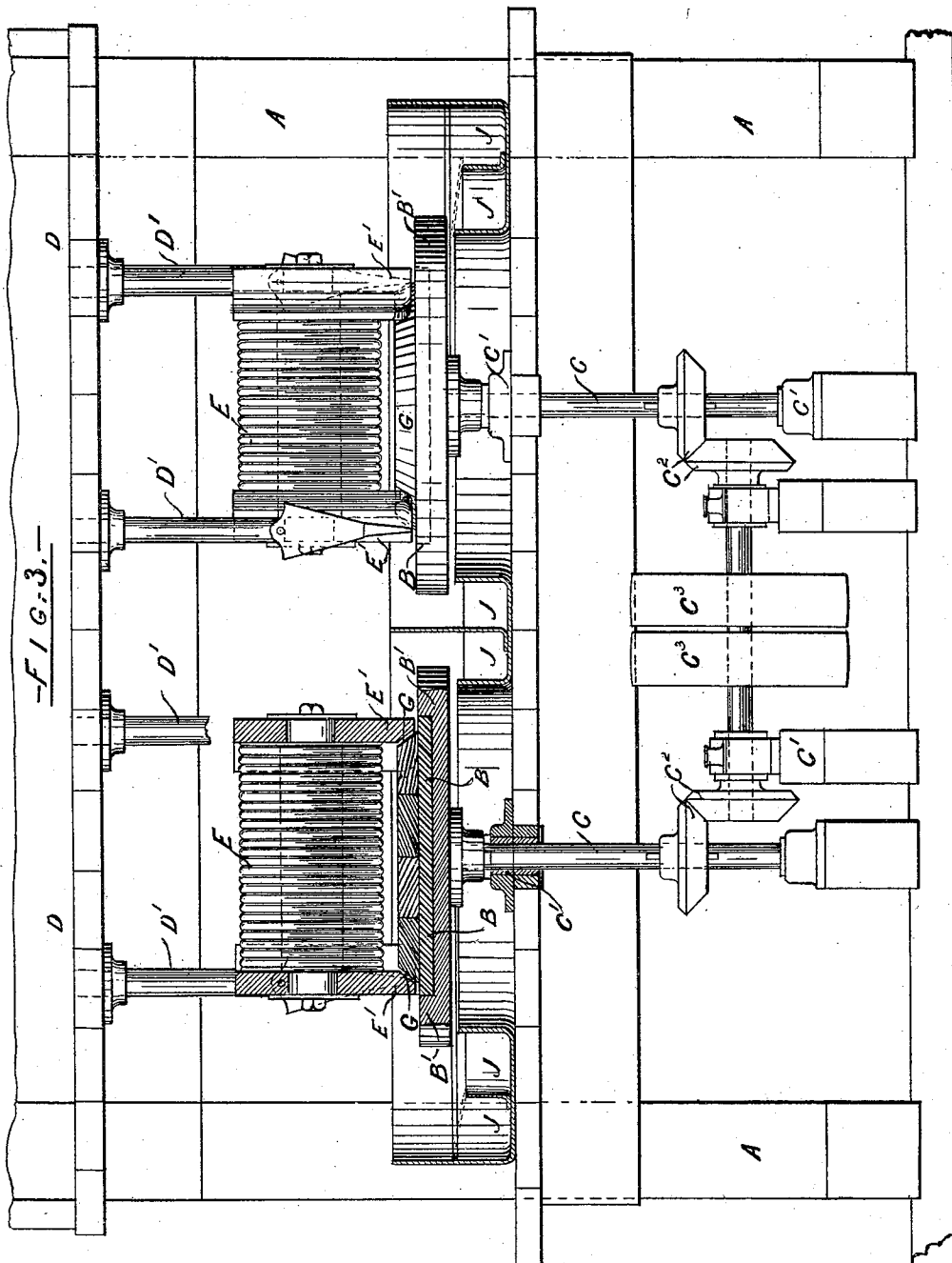
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(Application filed Oct. 12, 1899.)

(No Model.)

5 Sheets—Sheet 3.



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No. 686,402.

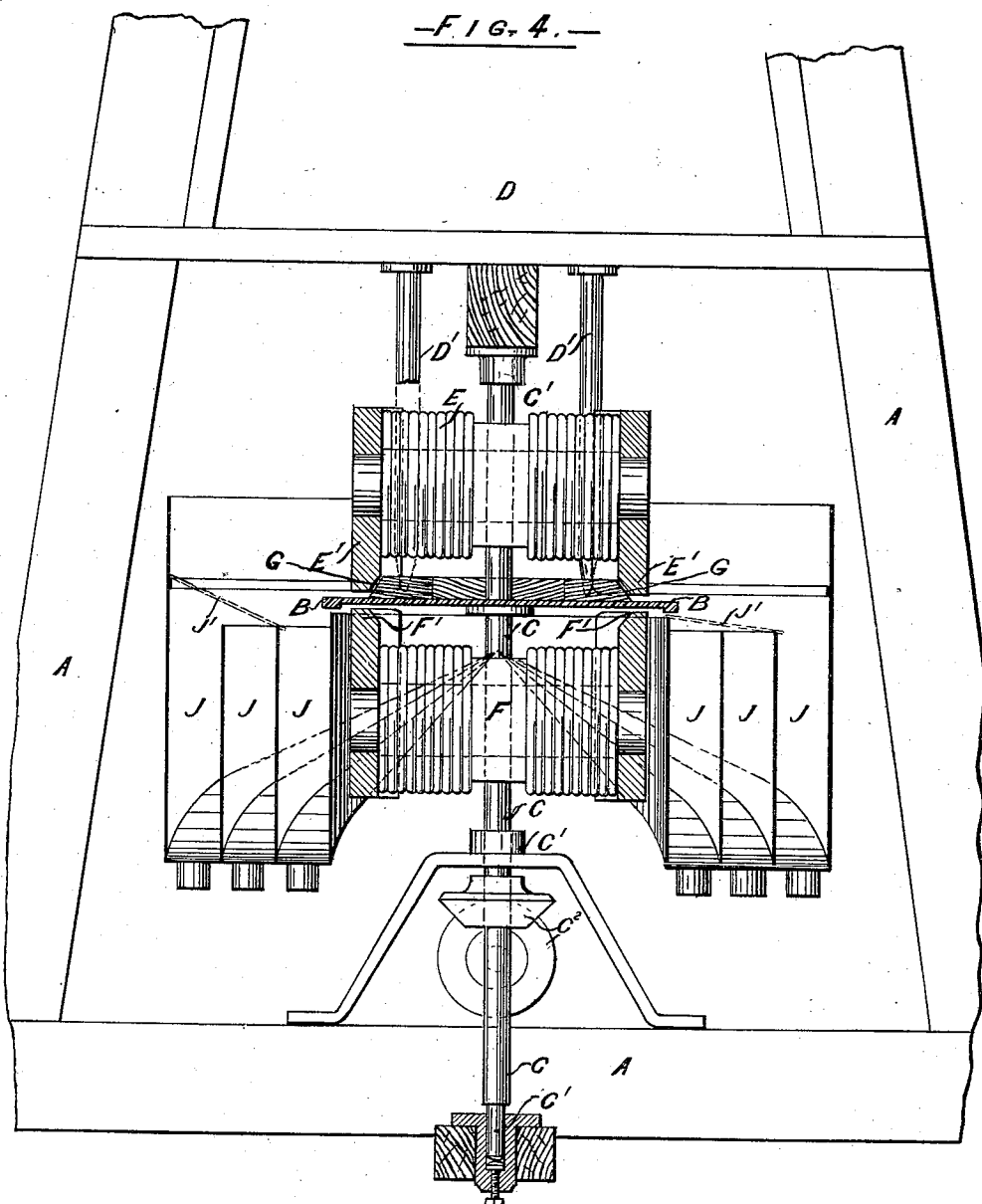
Patented Nov. 12, 1901.

T. J. GREENWAY.
MAGNETIC SEPARATOR.

(Application filed Oct. 12, 1899.)

(No Model.)

5 Sheets—Sheet 4.



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H. H. Green
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No. 686,402.

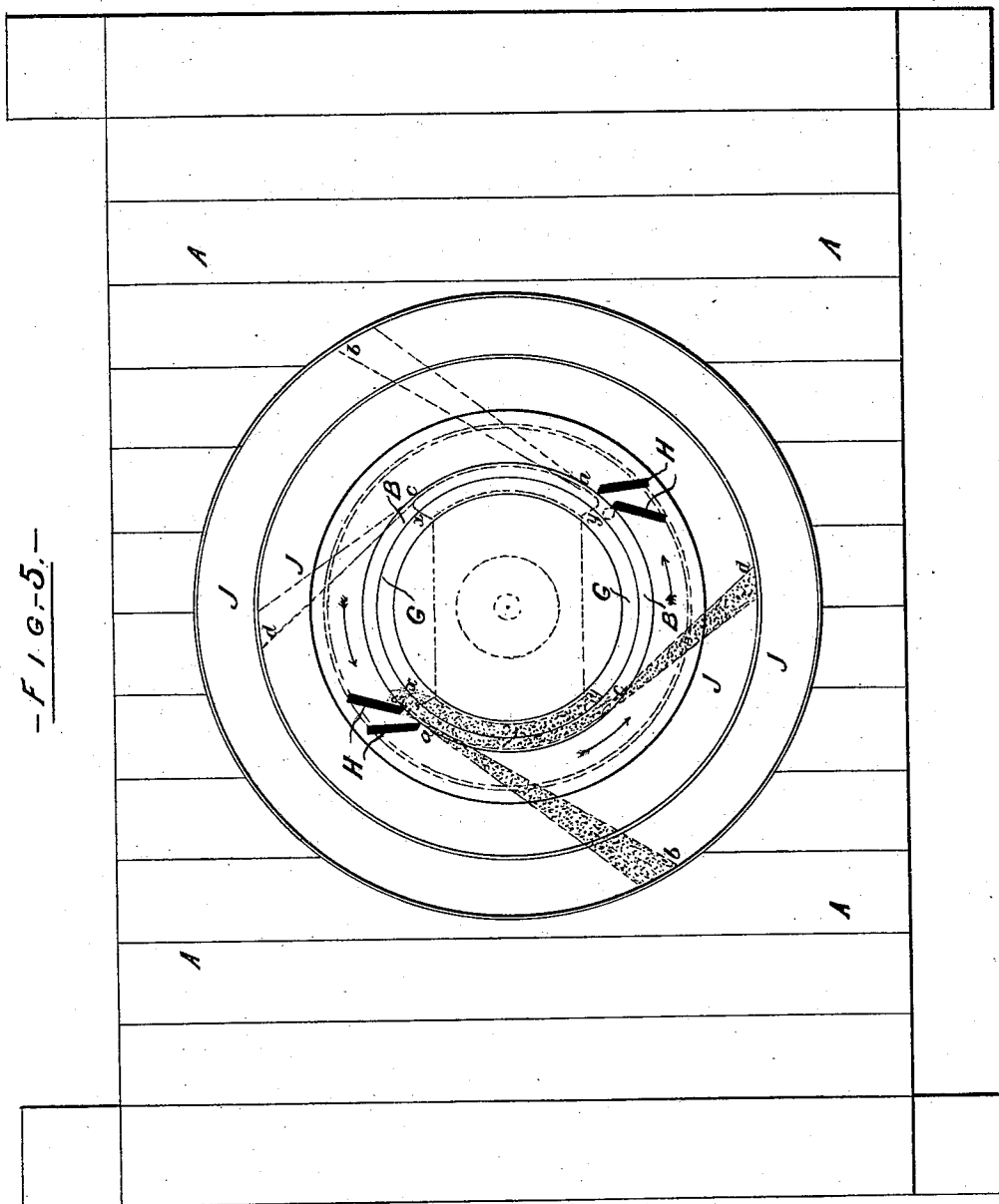
Patented Nov. 12, 1901.

T. J. GREENWAY.
MAGNETIC SEPARATOR.

(Application filed Oct. 12, 1899.)

(No Model.)

5 Sheets—Sheet 5.



Witnessed:
Attest
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Inventor,
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by *Henry O. Kelly*
Att'y

UNITED STATES PATENT OFFICE.

THOMAS JOHN GREENWAY, OF EAST ADELAIDE, SOUTH AUSTRALIA.

MAGNETIC SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 686,402, dated November 12, 1901.

Application filed October 12, 1899. Serial No. 733,430. (No model.)

To all whom it may concern:

Be it known that I, THOMAS JOHN GREENWAY, metallurgist, a subject of the Queen of Great Britain, residing at Second avenue, East Adelaide, in the Province of South Australia, 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 certain improvements in apparatus for the separation of magnetic from non-magnetic particles, or for the separation of materials of different degrees of magnetic susceptibility, more especially in the treatment of certain complex ores.

Though my invention is herein described as relating to the separation of magnetic from non-magnetic materials, I wish it to be well understood that the terms "magnetic" and "non-magnetic" include materials of different degrees of magnetic susceptibility.

In magnetic separators at present in use various mechanical devices are adopted for feeding the material into and through the magnetic fields. Most of these devices are more or less dependent upon the force of gravity for the travel of the material, and the separation of the magnetic portions from the non-magnetic is usually effected by deflecting the magnetic particles from the direct line of travel. These devices, however, require constant and fine adjustment in operation to adapt themselves to the varying nature of the material under treatment.

The object of my invention is to introduce the material into the magnetic fields in a simpler and more effective manner, capable of fine and easy adjustment, according to the degree of magnetic susceptibility of the particles contained in the material under treatment. I accomplish this object by subjecting the material to centrifugal force by feeding it onto a table rotating horizontally, capable of being driven at such rate of speed as may be found necessary. I provide such table with an arrangement of magnets in such manner that during its travel toward the edge of the table the material is caused to pass through magnetic fields of high concentration. By this means the magnetic particles

are retarded in their outward travel until they pass beyond the influence of the magnetic field, when they are delivered over the edge of the table at a given point. The non-magnetic particles in the meantime pass outward without check and are delivered over the edge of the table at a different point. This rotating table may be constructed of any suitable material. It is, however, preferably made wholly or in part of soft iron in order that the soft-iron portion of the table may act in relation to the pole-pieces of the electromagnets as a detached rotating armature. By this means magnetic fields of greater intensity are obtained. By introducing the material into the magnetic fields in this manner all the particles contained in the material under treatment are brought equally within the influence of the lines of magnetic force. Furthermore, the rate of the travel of the material into and through the magnetic fields may be regulated by adjusting the feed and the speed at which the table is driven, according to the varying degrees of magnetic susceptibility of the particles in the material under treatment.

Referring to the accompanying drawings, Figure 1 is a plan of my improved magnetic separator, showing a table having two electromagnets arranged above it with four downwardly-projecting pole-pieces; Fig. 2, a side sectional elevation of the same, taken on the line 2 2, Fig. 1. Fig. 3 is a side elevation, partly in section, of two tables arranged in pairs, each table being provided with one electromagnet arranged above it with two downwardly-projecting pole-pieces. Fig. 4 is a side sectional elevation of a table provided with electromagnets arranged both above and below. Fig. 5 is a plan showing diagrammatically the manner in which the separation of the material is effected.

A is the main framework of the apparatus and is preferably constructed of wood. Within this framework A is mounted a table adapted to be rotated horizontally. This rotating table may be constructed of any suitable material, but is preferably made wholly or in part of soft iron. In this manner the soft-iron portion of the table acts in relation to the pole-pieces of the electromagnets hereinafter described as a detached rotating ar-

mature. The table, as shown in Figs. 1, 2, and 4, consists of a flat soft-iron disk B. According to Fig. 3 the table is constructed partly of magnetic and partly of non-magnetic material, and for this purpose the soft-iron disk B is let into the center of a larger disk B', of brass, wood, or other non-magnetic material. The table or disk B is mounted upon a vertical shaft C, working in suitable bearings C' within the framework A, and is rotated by beveled gear-wheels C², driven by pulleys C³ in the ordinary way.

The material for treatment is fed upon the surface of the table or disk B in a regulated stream from hoppers D by chutes D'. These hoppers D and chutes D' are arranged in suitable positions, whereby the material may be fed onto the table at the entrance to the magnetic fields. As the table or disk B rotates, the material is thrown outward by centrifugal force, and the rate of its travel may be adjusted by regulating the speed at which the table is driven, according to the degree of susceptibility of the particles contained in the material under treatment.

In order to effect the magnetic separation, one or more electromagnets are provided, arranged about the table in such manner that the material as it passes outward by centrifugal force is caused to pass through magnetic fields of considerable intensity.

In Figs. 1, 2, and 3 the rotating table or disk B is provided with electromagnets E, arranged above and having downwardly-projecting pole-pieces E'. The lower extremities of these pole-pieces E' are in close proximity to the outer margin of the iron disk B, which thus acts in relation to the electromagnets E as a detached rotating armature. Thus between the lower ends of the pole-pieces E' and the surface of the disk B there are formed magnetic fields of great intensity, through which the material is caused to pass in its outward travel.

Referring to Fig. 4, the table or disk B is herein provided with an electromagnet F, arranged below the table, corresponding with the electromagnet E, arranged above. The electromagnet F has upwardly-projecting pole-pieces F' arranged in close proximity to the under surface of the table or disk B, and the pole-pieces E' and F', opposite to each other, are of opposite signs. Thus that portion of the table passing immediately between the pole-pieces E' and F' becomes inductively magnetized, and magnetic fields of great intensity are formed through which the material in its outward travel is caused to pass.

In order to bring all the material under the influence of the lines of magnetic force, I provide means whereby the material is heaped or banked up as it enters the magnetic field. For this purpose the table or disk B is preferably provided with an annular ridge or flange G, arranged a short distance within the outer edge or margin of the disk B in such manner that it passes just within the points

of the pole-pieces E'. Suitable brushes or wipers H are provided whereby the material is swept against this ridge G in a heaped or banked-up form. A channel or passage is thus formed between the points of the pole-pieces E' and the surface of the table or disk B and the ridge or flange G, which is highly charged with lines of magnetic force. This channel or passage thus forms a magnetic field of great intensity, through which the material is caused to pass.

Referring to Fig. 5, it will be seen that the material fed from the hopper D by means of the chutes D' passes onto the surface of the table or disk B immediately at the entrance to the magnetic fields before described and is then swept up by the wipers or brushes H against the ridge G, in which manner as the table rotates it enters the magnetic fields *x y*. (Shown as *x y* in dotted lines in Fig. 5.) The non-magnetic particles are immediately thrown outward by centrifugal force, as shown in dotted lines *a b*, Fig. 5, while the magnetic particles are retarded in their outward passage. Upon emerging from the magnetic field these magnetic particles are immediately thrown over the edge of the table at a different point, as shown by dotted lines *c d*, Fig. 5.

As the separated products are delivered over the edge of the table, they may be removed by suitable conveyer-belts or other devices, or may be received into launders or other receptacles J, arranged around the outer edge of the table B. Sliding covers J' are also provided, whereby one or any of these launders may be shut off and the material as delivered over the edge of the table discharged into any one, as may be required. The separated products are thus drawn off from their respective launders or receptacles, according to their degree of magnetic susceptibility.

I do not desire to claim herein the method of magnetically separating mixtures of magnetic and non-magnetic substances or mixtures of substances of different magnetic susceptibility, as this method or process forms the subject of a separate or divisional application, as required by the provisions of Rule 41 of the Rules of Practice.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. A magnetic separator, comprising a horizontally-revolving plate of magnetic material, electromagnets so arranged above and below said plate that poles of one polarity are opposite those of the other polarity and located to magnetize said plate by induction at certain points of its travel, means for feeding material onto magnetized portions of said plate, and mechanism for driving the plate, thereby carrying ore particles along the magnetic fields and centrifugally discharging non-magnetic particles from the edge of the plate

at magnetic, and magnetic particles at neutral portions of said plate, substantially as described.

2. A magnetic separator, comprising a horizontally-revolving plate of magnetic material, electromagnets arranged to produce a divided magnetic circuit and to magnetize said plate by induction at certain points of its travel, means for feeding material onto the surface of said plate at its magnetized parts, thereby causing said material to travel across one and along the other of said magnetic circuits, and means for imparting speed to said plate to centrifugally discharge from its edge non-magnetic particles from the magnetized portions and magnetic particles from the neutral portions of said plate, substantially as set forth.

3. A magnetic separator, comprising a horizontally-revolving flat armature of magnetic material, electromagnets arranged to magnetize said armature by induction at certain points of its travel, means for delivering material to be separated on the armature at the magnetized parts, and means for confining the material while on the armature within the path of the magnetic field, and mechanism for imparting speed to said armature to discharge only by centrifugal force from the edge of the armature non-magnetic particles, while in the magnetic field, and magnetic particles at the substantially neutral points.

4. A magnetic separator, comprising a horizontally-revoluble disk, a magnetic field at one or more points proximate to the perimeter of said disk, means feeding the material to be separated to the disk at the entrance to said magnetic field or fields, and means banking up said material at the said entrance, for the purpose set forth.

5. A magnetic separator comprising a revolving armature composed of magnetic material, magnets with both poles on one side of said armature, the latter forming part of the magnetic circuit, means for feeding ore on said revolving armature in advance of the poles and within the influence of said magnetic circuit, thereby separating the non-magnetic particles during their passage through, and the magnetic particles after their passage through the magnetic circuit, substantially as set forth.

6. In an ore-separator, a horizontally-revolving discoidal plate composed of magnetic and non-magnetic material arranged to form an active ring-armature, electromagnets organized to energize said active ring at certain points of its travel, and means for feeding material to be separated at the magnetic parts, substantially as described.

7. In an ore-separator, a revolving horizontal plate composed of magnetic and non-magnetic material arranged to expose an effective ring of magnetic material, electromagnets organized to energize said ring at

certain points of its travel and means for feeding material to be separated from the center on to said ring, substantially as described.

8. A magnetic separator comprising a horizontally-revoluble discoidal armature, electromagnets, having their poles facing said armature arranged at different points of its perimeter, means feeding the material to be separated to the armature at the entrance of the magnetic fields, and means banking up the material so fed at the said entrance, for the purpose set forth.

9. A magnetic separator comprising a horizontally-revoluble discoidal armature, electromagnets arranged in sets above and below said armature with their poles facing the same, at different points of its perimeter, means feeding the material to be separated to said armature at the edge thereof and at the entrance of the magnetic fields, and means banking up the said material at said entrances, for the purpose set forth.

10. A magnetic separator comprising a horizontally-revoluble discoidal armature, electromagnets arranged in sets above and below said armature with their poles facing the same, at different points of its perimeter, means feeding the material to be separated to said armature at the edge thereof and at the entrance of the magnetic fields, means banking up the said material at said entrances, and means confining the material to the edges of the armature, for the purpose set forth.

11. A magnetic separator comprising a horizontally-revoluble disk having an annular wall at a distance from and concentric with its perimeter, and electromagnets at one or more points of the perimeter of said disk and having pole-pieces overhanging said disk and forming with the aforesaid wall a channel for the passage of the material to be separated, for the purpose set forth.

12. A magnetic separator comprising a horizontally-revolving plate of magnetic material, positive and negative magnets arranged above said plate, and similar electromagnets arranged below said plate unlike poles being opposite one another and organized to magnetize said plate by induction at certain points of its travel, means for feeding material from the center toward the rim of said plate at its point of magnetization, and mechanism for driving the plate, thereby discharging centrifugally non-magnetic particles from the edge of the plate at the magnetized, and magnetic particles at the neutral points, substantially as set forth.

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

THOMAS JOHN GREENWAY.

Witnesses:

EDWIN B. COLTON,

CHARLES S. BURGESS.