

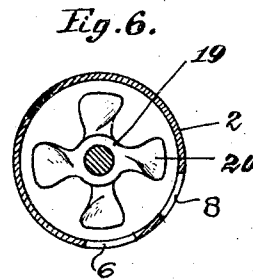
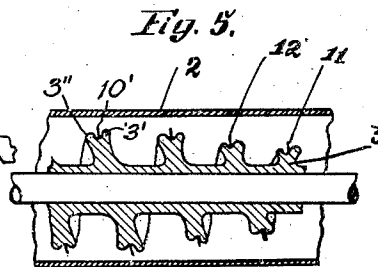
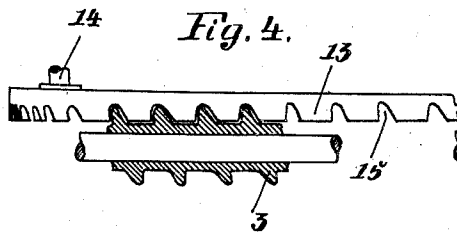
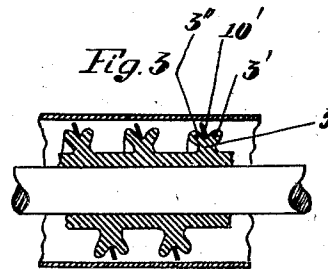
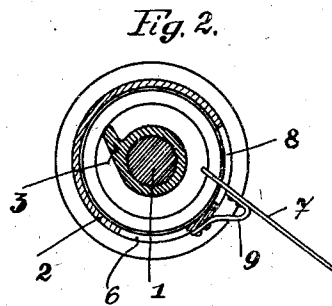
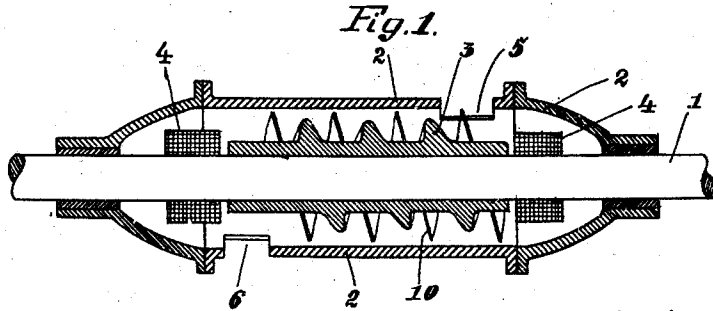
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B. GRANIGG

1,948,419

METHOD OF AND MEANS FOR THE MAGNETIC SEPARATION OF MATERIALS

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Inventor
Bertel Granigg
By *Hughes*
attorneys

UNITED STATES PATENT OFFICE

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METHOD OF AND MEANS FOR THE MAGNETIC SEPARATION OF MATERIALS

Bartel Granigg, Leoben, Austria

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in Austria September 2, 1929

10 Claims. (Cl. 209—221)

This invention relates to an improvement of the known process for the separation of goods or materials according to which the separation is carried out by means of roller-shaped iron bodies which are annularly subdivided and are caused to revolve in the field of a stationary system of magnets, and of means for the carrying out of this improved process. The separators operating according to the known process are only employable in connection with graded goods or material, which latter must moreover be delivered into the separator either in the dry state or in a stream of water for the purpose of obtaining tolerably useful results.

In accordance with the present invention the separation is effected in the following manner. The goods or material to be separated are caused to travel in an axial direction through a magnetic field by means of a conveyor-helix which itself forms one of the magnetic poles. This axial conveyance of the material through the separator enables the same to be continuously rolled about, so that all the fragments and particles of the material to be separated come in contact with the magnetized helix, this effect being increased by the fact that the separate turns of the helix are brought to bear in succession on the same material, whereby a cumulative or repeating action is achieved. It thus becomes possible with this improved process to charge the separator with ungraded material and to separate slimy, dry, or moist material with equal efficiency. The practical application of this process can be accomplished by means of a variety of devices, of which a few examples will be discussed and described in the following specification.

For the purpose of obtaining the field strengths required for the separating out of weakly magnetic material the helix is mounted, in accordance with the invention; on an axle consisting of material which is a good magnetic conductor, this axle being in its turn mounted in a longitudinally slotted iron cylinder. For the present purpose the helix consists of magnetic material and can have one or more turns, magnetizing coils being employed to magnetize the entire system in such a manner that the helix constitutes the one pole while the surrounding portion of the iron cylinder constitutes the other pole. In this manner an exceedingly powerful magnetic field is formed between the helix and the casing which is capable of causing even feebly magnetic material to cling to the surface of the helix. For the purpose of increasing the magnetic effect the outer edge of the helix may

be fissured throughout its length so as to present a Y-shaped cross-section, or the helical edge may also be given a particularly advantageous pole shape by the provision thereon of a plurality of grooves or slots. As has already been mentioned the material is moved through the apparatus in an axial direction during the process of separation. This function of the magnetized helix is reinforced by further non-magnetic conveyor-spirals provided specially for this purpose. A further measure for the purpose of intensifying the mixing and breaking-up action of the spirals consists in the providing of additional mixing arms. It is also possible to fill the portion of the separator traversed by the material with water and to allow the separator to work in standing (stagnant) water, by which means even the most minute magnetic particles can be extracted from the ungraded material. The separator can also work with running water, the material being caused to traverse the separator in a stream of water or other liquid. In the apparatus required for the carrying out of this principle the material, which is conveyed by the helix in an axial direction, is submitted to the process of separation several times in succession. It is also possible by the reduction of the diameter of some of the turns of the helix to increase at will the strength of the field and therewith the sensitiveness of the separator, or to carry out a separation of strongly and feebly magnetic material in one process and in one and the same separator.

Instead of a simple spiral or helical surface multiple helices can be employed. Finally it is possible to divide the cylinder longitudinally and to employ the two halves of the cylinder, between which the helix rotates, as pole shoes.

In each of these cases instead of the helix with continuous spiral turns separate blades resembling those of a propeller can be employed.

The delivery of the magnetic material lifted by the helix is effected either automatically by allowing the material to become detached in consequence of centrifugal force or of the force of gravity in the slotted open portion of the cylinder, or by the provision of scrapers or a magnetic shunt. For this purpose the scraper can be caused to engage in the turns of the helix, and is to this end slotted or comb-shaped and takes the form of an endless strip for the purpose of being able to participate in the movement of the helix.

Several forms of construction embodying the

invention are shown in the accompanying drawing, in which:—

Fig. 1 shows a helical separator diagrammatically in longitudinal section.

Fig. 2 is a cross-section through the delivery opening, while

Figs. 3 and 5 illustrate other practical modifications of the helix, likewise in longitudinal section.

Fig. 4 shows a delivery device.

Fig. 6 shows diagrammatically a further type of helix in cross-section.

The magnetizable axle 1 is mounted in an iron casing 2 closed except for a slot. On the axle 1 there is keyed the magnetic helix 3 which is magnetized by the coils 4 encircling the axle. The charging opening for the material for separation is denoted by the reference character 5, and is shown in the drawing for the sake of clearness in the upper portion of the casing 2, while in practice this opening is usually provided on a level with the axle. 6 denotes the delivery opening at the bottom of the casing 2. The scraper 7 (Fig. 2) is located in a slit 8 in the casing 2 and serves for the delivery of the magnetic material separated in the apparatus. A magnetic shunt 9 connects the scraper 7 with the adjacent portion of the casing 2 and thus weakens the magnetism of the helix in the region of the delivery opening. Fig. 1 shows at 10 a conveyor-helix of non-magnetic material which is inserted between the windings of the helix 3. In the form of construction for the helix shown in Fig. 3 the helix 3 is fissured as to its outer edge, so that two poles 3' and 3'' are formed. A non-magnetic helix 10' for the conveyance of the material can further be inserted between the poles 3' and 3''.

For the purpose of weakening the action of the helix at the point of entry of the material for separation and of enabling the powerfully magnetic material only to be separated out first the initial turns 11 and 12 of the helix 3 are of smaller diameter than the succeeding turns, as will be seen from Fig. 5. In addition, the helix may be designed with fissures as shown in Fig. 3, to form poles 3', 3'' and a non-magnetic helix 10'.

A delivery device serving for the scraping off of the magnetic material is shown in Fig. 4, and consists of a metallic strip 13 which runs over rollers 14 and is provided at one side with recesses 15 in which the turns of the helix 3 engage.

Fig. 6 shows a further development of the helix according to which the helix does not possess a continuous outer edge but is resolved into a number of fan-like portions 19 with suitably twisted blades 20.

For the magnetizing of the system apart from direct current any kind of alternating current may be employed.

I claim:—

1. The process of separating materials of different magnetic permeability which consists in generating a helical magnetic field the lines of force of which run radially, rotating the said field around its axis, introducing the said materials into the said field at one end thereof, mechanically conveying the said material continuously towards the other end of the said field, lifting out the magnetizable particles of the said material from the remainder thereof by magnetically conveying the same for rotation with the said field, weakening the said field along a fixed region crossing the thread of the rotating helical field, detaching the said particles in the

said region from the said field and discharging the said particles from the said field intermediate the two ends thereof, and mechanically discharging the said remainder from the said field at the opposite end thereof to that at which the said materials are introduced.

2. A device for separating materials of different magnetic permeability, comprising in combination with a slotted iron casing an axle of magnetic material adapted to be rotated within the said casing, a helical body or bodies attached to the said axle, magnetic connection between the said axle and the said casing, and means, such as coils, for magnetizing the said helical body or bodies, the said means being so disposed that the outer edge of the said helical body or bodies constitutes the pole of a magnetic system the lines of force of which traverse the gap between the said outer edge and the said casing.

3. The combination claimed in claim 2 with the outer edge of the helical body or bodies cleft throughout its length, so that a multiple pole is formed, for the purpose of increasing the magnetic effect.

4. The combination claimed in claim 2 with the individual turns of the said helical body or bodies being of increasing diameters measured from the entrance of the material to the discharge of the non-magnetizable remainder thereof for the purpose of weakening the action of the magnetic field at the point of entry of the material for separation and of enabling the powerfully magnetic material only to be separated out first.

5. The combination claimed in claim 2 with the individual turns of the said helical body or bodies being of increasing diameters measured from the entrance of the material to the discharge of the non-magnetizable remainder thereof for the purpose of weakening the action of the magnetic field at the point of entry of the material for separation and of enabling the powerfully magnetic material only to be separated out first, the outer edge of the said turns being cleft throughout its length, so that a multiple pole is formed, for the purpose of increasing the magnetic effect.

6. A device for separating materials of different magnetic permeability, comprising in combination with a slotted iron casing an axle of magnetic material adapted to be rotated within the said casing, a helical body or bodies of magnetic material attached to the said axle, magnetic connection between the said axle and the said casing, means for magnetizing the said helical body or bodies disposed about the said axle, and a helical body or bodies of non-magnetic material attached to the said rotating magnetic body or bodies as a projecting ridge adapted to aid the movement of the material.

7. The combination claimed in claim 2 with a cleft longitudinally of the outer edge of the turns of the said helical body or bodies, and a conveyor-helix of non-magnetic material in the said cleft.

8. The combination claimed in claim 2 with spokes between the said helical body or bodies and the said axle, and magnetizing coils embracing the said spokes and adapted to magnetize the adjacent turns of the said helical body or bodies in such a manner that a magnetic flux is set up between the outer edges, respectively, of the said adjacent turns.

9. A device for separating materials of different magnetic permeability, comprising in com-

5 bination with a slotted iron casing an axle of magnetic material adapted to be rotated within the said casing, a plurality of fan like twisted blades of magnetic material attached to the said axle, magnetic connection between the said axle and the said casing, and means, such as coils, disposed about the said axle for magnetizing the said blades.

10. The combination claimed in claim 2 with a scraper for the detachment of magnetic particles from the said helical body or bodies consisting of an endless comb-shaped strip adapted to engage the turns of the said helical body or bodies. 80

BARTEL GRANIGG.

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