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## MAGNETIC SEPARATOR

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The present invention relates to magnetic separators, and more particularly to such separators in which the material to be separated is delivered to a moving surface of unmagnetic material as for instance, a rotating drum or a conveyor-belt, and, at and near the point of delivery, is subjected to the action of a magnetic field which may be produced by a stationary electro-magnet. The unmagnetic constituents of the material pass this arrangement and fall off without being affected by the magnetic field. The magnetic particles adhere to the surface of the drum or belt and are carried out of and thereby removed from the material; when, by further rotation of the drum or belt, they have left the magnetic field, they finally drop off.

The hitherto known magnetic separators of this type have certain disadvantages. If the surface of the drum or belt is smooth, the magnetic particles, instead of leaving the magnetic field, often tend to glide on the surface and thereby to remain in the field. The same phenomenon can be observed inside the field, at such points or lines, where the intensity of the field varies suddenly because the drum or belt material is not homogeneous. Of course, this disadvantage is especially apparent when the strength of the magnetic field, in order to have a good separation, is increased as much as possible. It has been proposed to avoid this gliding of the material by arranging slightly protruding ribs on the moving surface vertically to the direction of its movement, or by roughening the surface. But thereby the deposition of a permanent layer of material on the surface of the belt or drum is facilitated, which cannot or only with great difficulty be removed therefrom by brushing or scrubbing. This layer, while smoothing the surface again, also diminishes the strength of the magnetic field. Moreover, unmagnetic particles may be carried across the magnetic field by the ribs, so that separation is bad.

It has also been proposed, in order to increase the efficiency of magnetic separators at strong magnetic fields, to arrange a great number of parallel bars of magnetic material on the surface of the smooth drum or belt, vertically to the direction of its movement. The distance between two such bars, however, was so small, that many particles, instead of leaving the magnetic field, were attracted by the next successive bar and thereby taken back into the field, so that they could not drop off from the belt or drum.

It is the object of this invention to avoid these disadvantages and to furnish a magnetic separator which, even at strong magnetic fields, will allow efficient and complete separation of magnetic and unmagnetic material.

In the following, the invention will be described as applied to a magnetic separator of the drum type. As above stated, such separators consist of a drum of unmagnetic material. Inside the drum there is placed a stationary magnet which, at and near the point at which the material is delivered to the surface of the drum, produces a strong magnetic field. According to my invention, the drum has a smooth surface, and is provided with one or at the most a few bars of magnetic material, especially iron, being preferably placed vertically to the direction of movement of the drum-surface. It is essential that, if several such bars are used, they are placed at such a distance that no appreciable magnetic flux is created between successive bars. Moreover, the bars should not protrude above or sink below the level of the surface. Therefore, the bars are arranged either flush with the surface of the drum, or, if they are placed below the surface, the gap is filled by unmagnetic material so that the surface remains smooth. The latter arrangement, although the magnetic field is weakened thereby, may sometimes be preferable, for instance, if the material to be separated tends to corrode the magnetic material of the bars. The bars may consist of iron-sheeting which is welded and/or riveted to the unmagnetic drum-material. Their breadth may be adapted to the size of the particles to be separated and to the dimensions of the drum. It was found that in the ordinary drums of 200 mms diameter, two bars placed opposite each other and having a breadth of about 25–30 mms give good results in almost every case, whereas in 400 mms drums, four such bars placed at right angles may be advantageously used. Drum and bar may be of equal thickness, for example 2–3 mms.

By the magnetizable bar or bars according to my invention, the magnetic flux is concentrated in a certain area of the surface of the drum during its passage across the magnetic field. Magnetic particles, therefore, are especially attracted in that area and are carried across and outside of the magnetic zone without gliding. It is possible, therefore, to apply very strong magnetic fields without diminishing the efficiency of the separator. Separation itself is very good because there are no protruding elements of the surface which might carry unmagnetic material across the field. Nor is there any weakening of the strength of the field by the formation of a per-

manent layer of material on the surface of the drum. And, last not least, these advantages are obtained with a drum which is as simple and inexpensive as possible.

It is self understood that my invention can be applied with the same result to other magnetic separators of similar type, for instance, to the belt separator in which a smooth conveyor-belt of unmagnetic material is used instead of a drum. A bar or bars of magnetizable material are placed in or beneath the surface of the belt, about parallel to each other and vertically to the direction of its movement. If several bars are used, their distance should be such as to prevent any appreciable magnetic flux between two successive bars which might draw back the material which is about to leave it, into the magnetic zone.

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