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(54) MAGNETIC SEPARATOR

(71) We, FIVES-CAIL BABCOCK, a French Body Corporate, of 7, Rue Montalivet, 75383 Paris Cedox 08, France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a magnetic separator of the induction member type, for the treatment of finely divided minerals and ores, and relates more particularly to induction members in the form of plates between which circulates the product to be treated, and it also relates to the design of these plates.

Magnetic separators of the induction type are well known and are becoming increasingly used in the minerals industry for the treatment of ores and minerals, in view of the fact that they are highly effective even when they have to cope with products which are very fine and/or of low magnetic susceptibility. These separators are of widely diverse designs; the flow of products to be treated, in suspension in a fluid, may be vertical, horizontal or follow a more or less substantial slope, according to the disposition of the pole pieces, the shape of which, likewise variable, influences the form of the magnetic field. There may be several superposed or successive separation zones or chambers, but all the separators of this type have induction bodies forming a large number of clearances of small width, in order to increase the strongly magnetic contact surfaces on which the particles which may be very fine and of low magnetic susceptibility may cling.

These induction bodies may be mounted in fixed or movable fashion in the area in which the magnetic field prevails; in some appliances, they perform a rotary movement about a horizontal or vertical axis; in others, it is the magnets which are mounted on rotary members which rotate about the fixed induction members. The induction members may be continuously or intermittently exposed to a magnetic field.

Various materials have been used to produce these induction bodies and they take widely diverse forms, such as steel wool, metallic wires or gauzes, steel balls, flexible plastic strips impregnated with particles of magnetic or ferrosilicon, barred grids of the split grid type, or grooved or channelled plates. More often than not, the grooves in these last plates are very superficial and may likened to scratches. Also known are assemblies formed of superposed plates, of which only one face carries ribs which are in contact wih the plane face of the adjacent plate and separated by grooves, in such a way as to form triangular passages for the flow of products to be treated.

The drawback with the majority of these induction bodies is that of offering a considerable number of inactive zones and little opportunity for the passage of products to be treated, which has an unfavourable effect both on the separating efficiency and on the capacity of the magnetic separator.

According to the present invention there is provided an induction type magnetic separator for the treatment of finely divided minerals and ores, comprising one or more fixed or movable groups of plates constituting induction bodies between which the product to be treated is arranged to circulate, some or all of the plates having parallel grooves on both faces thereof, the ridges of the grooves on one said grooved face of a said plate being located opposite to the hollows in the grooves on the other said grooved face of the same plate, the said group or groups of plates being arranged in an enclosed cassette through which the product to be treated is arranged to flow.

A plurality of these plates are grouped in such a way that the ridges of the grooves of the plates are located opposite the hollows of the grooves of the next plate. The grooves and the ridges may be of triangular cross-section. This grouping is carried out so that a space is left between each of the plates, this space depending upon the granulometry of the products to be treated, their content of particles which are likely to adhere under the influence of the mag-

netic field and on the intensity of this field. The spacing is generally the same for all of one group of plates.

Several groups of plates may be used either in parallel or in series. These groups are readily adapted to various types of known induction magnetic separators, such as separators having vertical or horizontal separation chambers, having permanent magnets or electro-magnets, having fixed or movable induction bodies, or which are continuously or intermittently subjected to a magnetic field.

It is possible to conceive of magnetic separators having a plurality of groups of plates and for each group a different spacing of the plates *inter se*, which, by putting those plates which are spaced apart by the maximum at the top, would make it possible first of all to separate those particles which are most sensitive to the attraction of the magnetic field.

The plates are grouped into an enclosed cassette. They are made wholly or partly of magnetic material. They are manufactured preferably from special stainless steel offering high saturation induction. It is of course possible to protect them against corrosion and abrasion by any suitable process.

The induction type magnetic separators which are the subject of the invention offer many advantages over separators used hitherto and particularly over known separators fitted with induction members in the form of plates:

— for one and the same means magnetic field established in the clearances between the induction members, a much lower potential is required;

— they make it possible to obtain the greatest number of clearances of maximum width in a location of given dimensions,

— and they offer the maximum field gradient and hence the greatest magnetic force of attraction.

By way of non-limitative example, the attached drawings will make it possible to understand more clearly the object of the invention. In the drawings:

Fig. 1 represents a sectional view of the clearance in a magnetic separator with the plates grouped in a cassette;

Fig. 2 shows on a larger scale two fragments of adjacent plates; and

Fig. 3 is a view similar to Fig. 2 but showing an alternative embodiment.

In Fig. 1, the cassette 10 with the induction bodies 12 within it, is shown between the pole pieces 16 and 18 of a magnetic separator which is not shown in its entirety. The assembly of induction bodies 12 is formed by grouping together plates 14 shown on an enlarged scale in Fig. 2, which shows particularly clearly the respective disposition of the ridges and hollows on the two faces of one and the same plate and their disposition for two neighbouring plates which define the clearance 20.

In Fig. 2, the hollows and ridges are of triangular cross-section, the angles formed by two adjacent faces being all the same and of 90°. In Fig. 3, the hollows and ridges on the plates 14^1 are rounded. It goes without saying that these drawings are given only by way of example and that the angles between the faces may equally well be acute or obtuse. The ridges and the hollows may be of forms other than those illustrated and may for example be of trapezoidal cross-section. These plates may be used in all types of induction separators.

Since the way in which induction type magnetic separators function is already known *per se*, it will not be expounded here. The induction bodies made according to the invention offer a minimum of inactive zones and, for the same magnetic potential, a maximum force of magnetic attraction, so that fine particles and particles of low magnetic susceptibility are attracted and adhere thereto without problem. The gap between adjacent plates has little or no constrictions and will make it possible to treat a maximum throughput of products within a given enclosure.

With the plates of the present invention, therefore, it will be possible to produce magnetic separators of high intensity and high capacity which will find numerous industrial applications, particularly for the purification of fluids containing fine magnetic or magnetisable particles and for the separation of these same particles from suspension containing a mixture of magnetic and non-magnetic products.

WHAT WE CLAIM IS:—

1. An induction type magnetic separator for the treatment of finely divided minerals and ores, comprising one or more fixed or movable groups of plates constituting induction bodies between which the product to be treated is arranged to circulate, some or all of the plates having parallel grooves on both faces thereof, the ridges of the grooves on one grooved face of a said plate being located opposite to the hollows in the grooves on the other grooved face of the same plate, the said group or groups of plates being arranged in an enclosed cassette through which the product to be treated is arranged to flow.

2. A magnetic separator according to claim 1, wherein the hollows are of substantially triangular cross-section.

3. A magnetic separator according to claim 1 or 2, wherein the ridges are of substantially triangular cross-section.

4. A magnetic separator according to claim 1, wherein the ridges and the hollows of the grooves are each rounded.

5. A magnetic separator according to any preceding claim, wherein several plates are grouped together, the ridges of the grooves on one said plate being located opposite the hollows of the grooves of an adjacent said plate.

6. A magnetic separator according to any preceding claim, wherein the spacing between the different plates in one and the same group is substantially the same at any chosen point in this group.

7. A magnetic separator according to any preceding claim, wherein several groups of plates are arranged in series.

8. A magnetic separator according to any preceding claim, wherein several groups of plates are arranged in parallel.

9. A magnetic separator according to claim 7, wherein the spacing between the plates of which the several groups are composed varies as between one group and another.

10. A magnetic separator according to any preceding claim, wherein some or all of the said plates are composed of a stainless steel of high saturation induction.

11. A magnetic separator substantially as hereinbefore described with reference to any one of Figs. 1 to 3 of the accompanying drawings.

12. A product which has been treated by means of a magnetic separator as claimed in any of claims 1 to 11.

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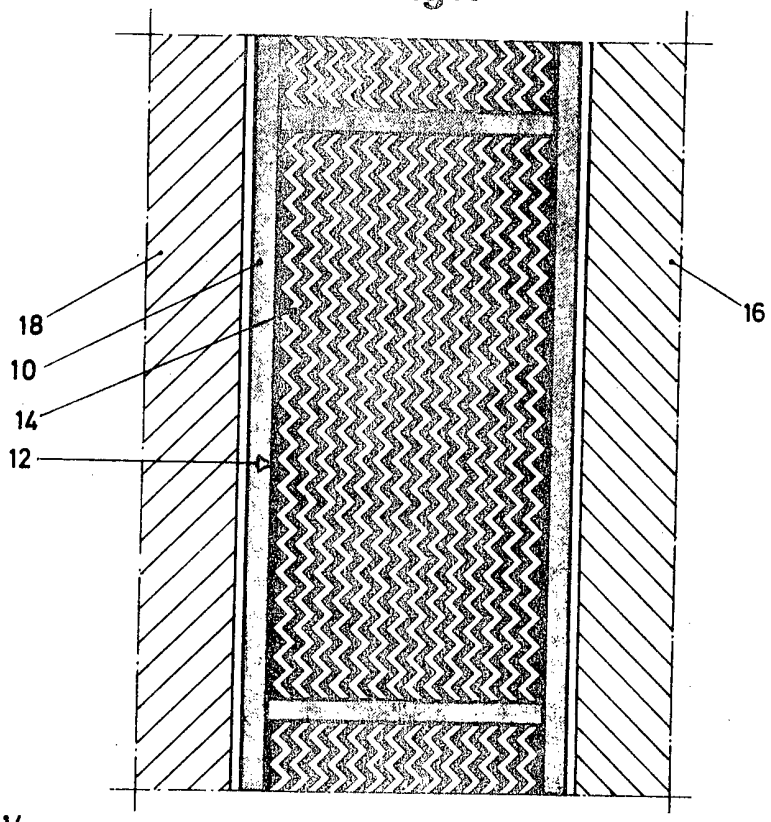
1576071 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

Fig.1



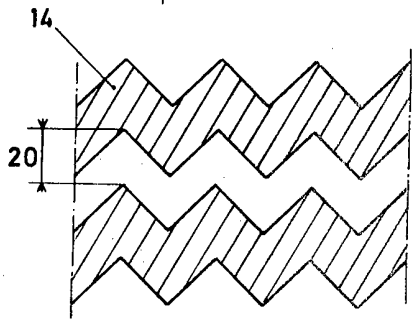


Fig:2

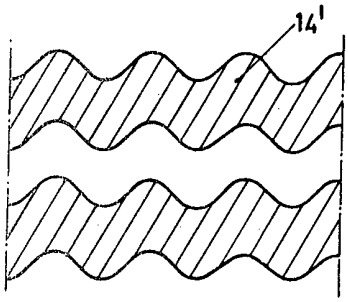


Fig:3