

Sept. 28, 1926.

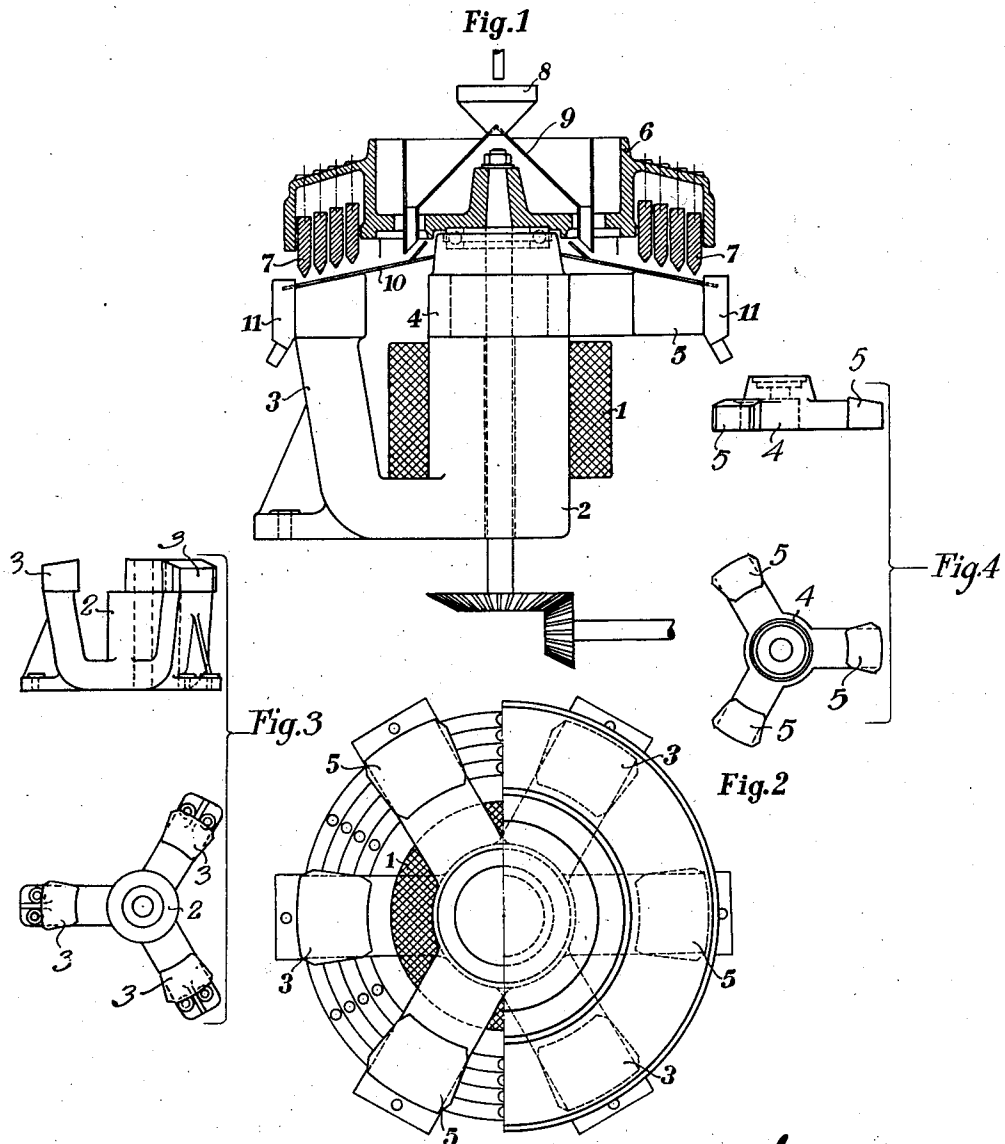
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G. ULLRICH

MAGNETIC SEPARATOR

Filed Dec. 19, 1924

3 Sheets-Sheet 1



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Sept. 28, 1926.

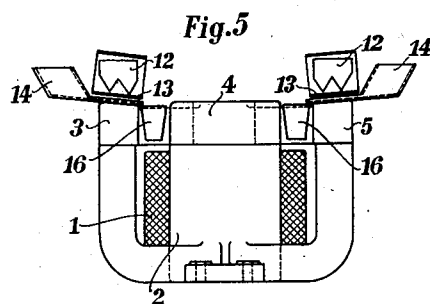
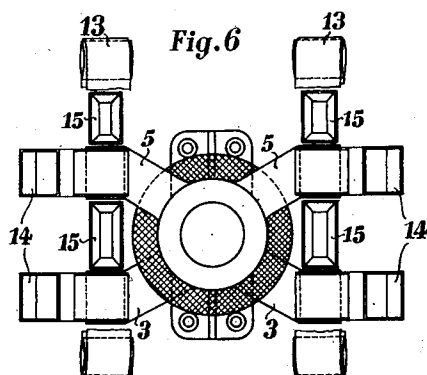
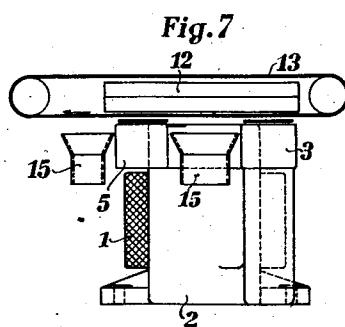
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MAGNETIC SEPARATOR

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3 Sheets-Sheet 2



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MAGNETIC SEPARATOR

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3 Sheets-Sheet 3

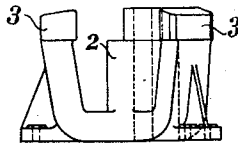


Fig. 3

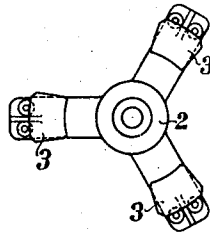
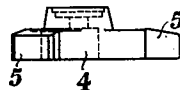
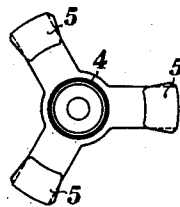


Fig. 4



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UNITED STATES PATENT OFFICE.

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MAGNETIC SEPARATOR.

Application filed December 19, 1924, Serial No. 757,009, and in Germany January 11, 1924.

The present invention relates to magnetic separators of the type in which the material to be separated is acted upon at several points simultaneously.

5 Magnetic separators with a number of separating points are known in which there are a number of poles so connected to a common magnet core that the poles are arranged in two concentric circles, half the
10 number thereof being connected to one end of the magnet core and the other half to its other end, and all the poles being excited conjointly by a coil which surrounds the core of the magnet. At the same time the
15 poles are so arranged that every pair of opposite polarity are located radially opposite each other on both sides of a common armature ring which rotates between all the poles. Every such pair of poles presents therefore
20 two separating points, one of which is formed between the outer pole and the ring and the second one between this latter and the inner pole. In this arrangement the armature ring does not rotate, as has heretofore been customary in ring armatures,
25 on a stationary central shaft, but on a number of rollers, which are provided for the purpose of preventing it from shifting laterally. A disadvantage that may arise in this
30 arrangement is that, owing to the wearing of the bearing surfaces of the annular bearing rollers, the ring very soon runs eccentrically with relation to the pole pieces. The surfaces between which the separating fields
35 exist are consequently located at different distances from each other and the separation therefore ceases to be uniform. If the eccentricity be great there is even the risk of the ring touching one of the poles with the
40 result that it becomes jammed fast thereby. As in a separator of this type the material is attracted to the vertical side faces of the ring only, it is impossible to construct such separators in the form of zone separators.
45 The material which passes from above downwards through the two gaps in the field of a separating point adheres firmly not only to the armature ring but to the poles also, and then settles down in the gaps in the field and
50 prevents separation from taking place. The lines of force run at each separating point transversely through the armature from the N to the S pole, and, in such an arrangement, it is not possible to form a flux of lines of
55 force running from separating point to sep-

arating point through the armature and leaving a neutral zone between two separating points, as two fluxes of lines of force of opposite directions would in such case pass between the outer and inner poles of adjacent separating points and would mutually
60 neutralize each other.

Other magnetic separators are also known in which all the poles are excited conjointly by a central coil and are connected to one
65 end of the core of a magnet, the other end of the core being magnetically connected to a zone armature rotating above the poles and acting at the same time as a common delivery member for them. The disadvantage
70 of these separators, in which all the poles of the same polarity follow each other round in a circle, is that the attracted material is difficult to remove from the armature as in this case it does not completely lose its
75 magnetism between the poles.

According to the present invention only one pole is provided at each separating point, and above the poles is located an armature, such as is known per se, common to
80 all or at least to two poles, so that the field of each separating point is formed by one pole and the armature.

The poles of adjacent separating points are connected to the opposite ends of a common magnet core which is excited by a coil,
85 thus forming a series of successive poles all of which are in juxtaposition to the same surface of the common armature. The lines of force lie between the poles of adjacent
90 separating points and along the armature in the direction of its periphery or longitudinally.

In comparison with those above mentioned, this type of construction possesses
95 the following advantages; it can be used both for ring separators as well as separators in which the separating fields follow or succeed each other in straight lines, that is to say for example on belt or apron
100 separators which have a number of separating points and a common conveyor belt; both the ring separators and the belt separators of this type may be constructed as zone
105 separators. As successive poles are formed in the armature in this construction, there is always one point on the armature between every two poles the magnetic strength of which is equal to zero, so that the material
110 which has been attracted will therefore drop

off readily at this point. The advantage of the separator which forms the subject matter of the present invention in comparison with those heretofore known in which the poles are connected alternately to the ends of a common magnet core is therefore that the separation is far better and more complete, and in comparison with the separators of the type above mentioned and the usual ring separators it has also the advantage of being of a simpler type of construction, of less weight and therefore costs less to manufacture although it possesses the same number of separating points, the same strength of field and capacity.

In order that the invention may be clearly understood and readily carried into effect it will now be described by reference to the accompanying drawings, in which:—

Figure 1 shows, partly in longitudinal section, a ring separator of the new type of construction constructed as a zone separator.

Figure 2 is a plan view of the separator, the armature being shown as removed from the left-hand side of the figure.

Figure 3 shows the underneath portion of the magnet frame of a ring separator of the type herein referred to in elevation and plan.

Figure 4 shows the corresponding upper portion thereof in elevation and plan.

Figure 5 is a longitudinal section,

Figure 6 is a plan and

Figure 7 is a side elevation of a belt separator constructed as a wet zone separator in accordance with this invention.

Referring to Figures 1-4, the poles 3 are cast with the magnet core 2 which is excited by the coil 1 shown in Figure 1 or connected thereto in some other manner. Upon the magnet core 2 is mounted the upper part 4 of the magnet frame, the poles 5 of which are arranged in a circle between those of the upper part in such a way that a north pole connected with one end of the magnet core is always followed by a south pole connected with the other end of the magnet core, so that so-called successive poles are formed. Above the poles rotate the armature which is common to all the poles and which may consist of the armature plate or disc 6 and the armature rings 7.

The pulp to be operated upon is charged in at the hopper 8 and flows over the cone 9 and the guide plates 10 down through the armature rings 7 which are set at progressive heights relatively to the poles so that the inner ring is farthest from the poles and can therefore only attract the material of the greatest permeability, while the outer ring is located nearest to them and consequently serves to attract the material of the least permeability. The portion of the material not attracted flows away through the box 11. As a neutral zone must be formed in the armature between every

north pole and a south pole the different grades of material attracted by the different zone rings 7 drop off at this point and are there removed separated according to zones.

In the modification illustrated in Figures 5, 6 and 7 the magnet core 2, which is excited by the coil 1, is provided with poles 3, while the upper part 4 of the magnet frame carries poles 5. In this case also the poles of one end of the core are so staggered relatively to the poles of the other end of the core that they form together successive poles. Above every two poles is arranged a stationary zone armature 12, under which rung the conveyor belt 13 which serves to carry away the magnetic material after separation. The material to be separated is charged in at the box 14, from which it is conveyed away at right angles by the conveyor belt over the poles so that the magnetic material is carried over by the conveyor belt, by magnetic attraction to its underside into the box 15 and the non-magnetic part of the material carried away by the box 16. In this case the poles are divided up into two rows so that every pair of poles co-operates with a common conveyor belt. The magnet frame may however also be so constructed that, when the excitation is central, all the poles lie in one series and form successive or consecutive poles. The invention can be used for wet and dry separators.

I claim:—

1. In a magnetic separator, a magnet core, a series of poles of alternate polarity, the poles of one polarity being magnetically connected with one end of said core and the poles of opposite polarity being magnetically connected with the other end of said core, and an armature common to at least two poles of opposite polarity.

2. In a magnetic separator, an upright magnet core, a series of poles of alternate polarity, the poles of one polarity being magnetically connected with the upper end of said core and the poles of opposite polarity being connected with the lower end of said core, all of said poles lying substantially in the same plane, and an armature common to at least two poles of opposite polarity.

3. In a magnetic separator, an upright magnet core, a circular series of poles of alternate polarity, the poles of one polarity being magnetically connected with the upper end of said core and the poles of opposite polarity being connected with the lower end of said core, all of said poles lying substantially in the same plane, and an armature common to at least two poles of opposite polarity.

In testimony whereof the foregoing specification is signed.

DR. ING. C. H. GEORG ULLRICH.