

C. M. GREEN.
MAGNETIC SEPARATOR.
APPLICATION FILED DEC. 10, 1904.

910,664.

Patented Jan. 26, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

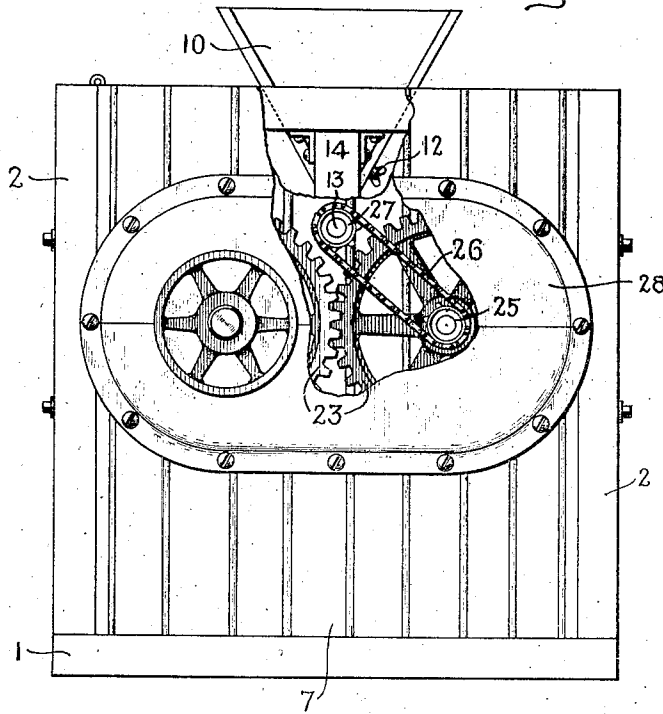
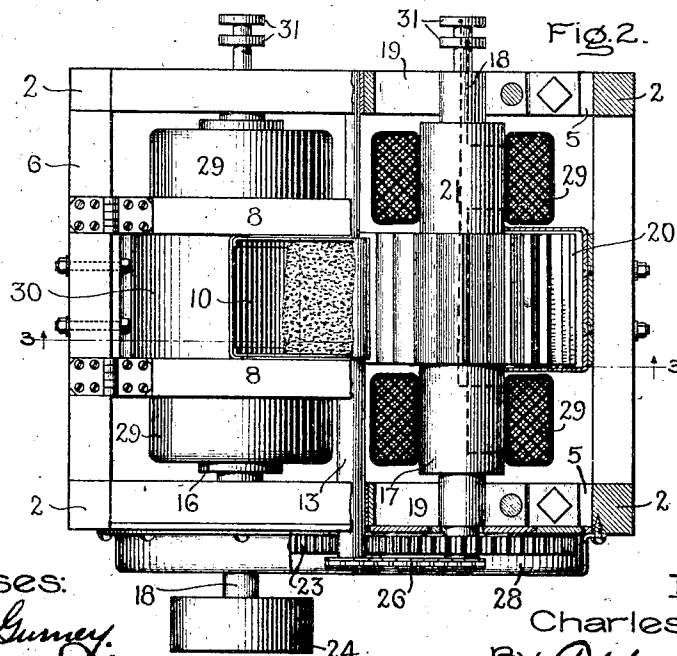


Fig. 2.



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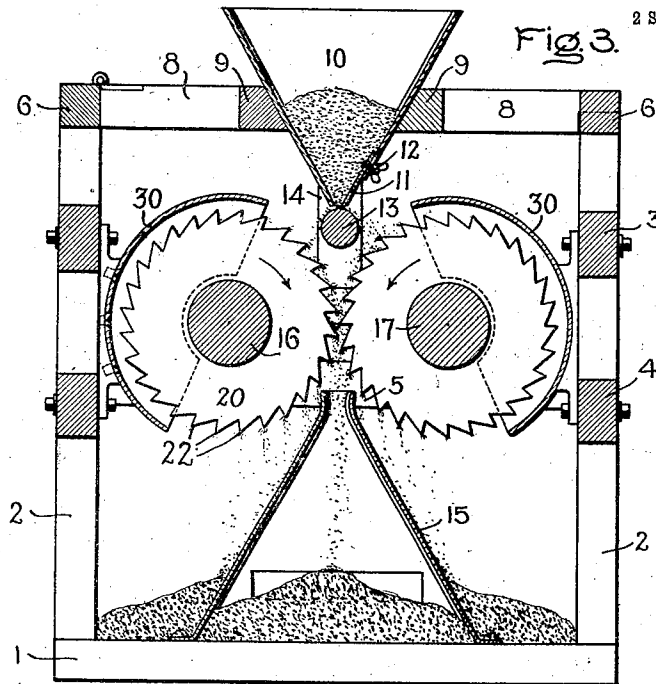


Fig. 3.

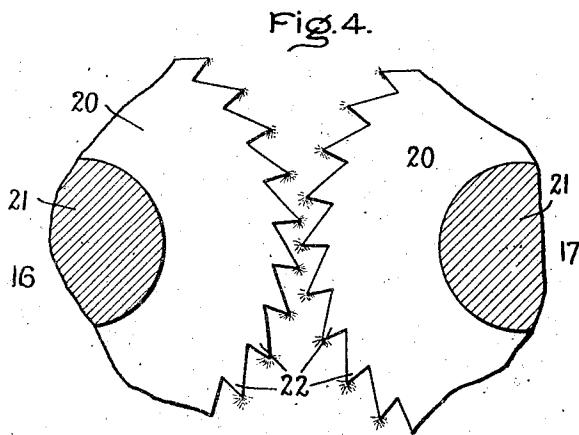


Fig. 4.

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Helen A. Ford

Inventor,
 Charles M. Green,
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UNITED STATES PATENT OFFICE.

CHARLES M. GREEN, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

MAGNETIC SEPARATOR.

No. 910,664.

Specification of Letters Patent.

Patented Jan. 26, 1909.

Application filed December 10, 1904. Serial No. 236,291.

To all whom it may concern:

Be it known that I, CHARLES M. GREEN, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Magnetic Separators, of which the following is a specification.

The present invention relates to magnetic separators for the removal of magnetic particles from granular or pulverized mixtures containing both magnetic and non-magnetic substances.

The object of my invention is to provide a simple and cheaply manufactured magnetic separator which will operate rapidly and effectually to remove all the magnetic particles, even those feeblest magnetic, from mixtures containing the same.

In carrying out my invention I mount upon a suitable frame a hopper for receiving the granular mass, and having at its lower end means for discharging the mass in a uniform stream to the operation of the separating devices, and below the latter are arranged suitable receptacles for containing the separated particles. The separating means consists of two massive iron rollers journaled in the frame horizontally and provided at their ends with extensions which serve as cores for the magnetic exciting coils, and their peripheries are provided with regularly-spaced longitudinal teeth or wedge-shaped projections.

The rolls are caused to rotate in unison by providing them with intermeshing gears or otherwise so that in the plane of their axes the teeth or projections of one roll will overlap the teeth or projections of the other roll without contacting. The function of these teeth or projections is to cause a rolling or stirring of the mass as it falls between the rolls and to concentrate the magnetic lines of force which issue from the periphery of one roll, traverse the intervening space and enter the periphery of the other roll, so that the action of the lines of force is rendered more intense and consequently effective to impel all the magnetic particles including the feeblest magnetic to the teeth or projections of the rolls. As the teeth or projections move away from the magnetic field between the rolls, the particles collected thereby during the passage through the field drop off into the receptacles provided therefor; while

the non-magnetic particles being uninfluenced by the magnetic field pass vertically from the lowermost of the overlapping teeth or projections of the rolls and are caught in a separate receptacle.

For a more complete understanding of my invention reference may be had to the following detailed description and the accompanying drawing forming a part of this specification, in which—

Figure 1 is a side elevation with parts broken away showing a magnetic separator embodying one form of my invention; Fig. 2 is a top plan with part in section of the same; Fig. 3 is a vertical section in a plane at right angles to the axes of the rotating parts; and Fig. 4 is a fragmentary view of the rolls indicating the assumed arrangement of the magnetic lines of force issuing from or converging toward the teeth or projections thereof.

The frame of the device consists of sills 1, corner posts 2 connected at the ends of the frame by horizontal bars 3, 4, and at each side of the frame by bars 5, and the tops of the corner posts are connected by a plate 6. The front side of the frame may be inclosed by sheathing 7.

Extending across the top opening and hinged to the plate 6 at one end thereof are two bars 8 connected by cross pieces 9 and supporting a V-shaped hopper 10, having a discharge opening at the lower end which is made adjustable by a slide 11 provided with a thumb screw 12 to clamp it in adjusted position. Extending across the frame immediately beneath the discharge opening is a roller 13 journaled in short posts 14 which serves to spread out the granular mass as it discharges from the hopper and thereby causing it to engage a greater portion of the periphery of the magnetic separating means, as indicated in Fig. 3. Beneath the separating means is arranged an inverted V-shaped box 15 with an opening at its upper end through which the non-magnetic particles may fall while the inclined sides receive the deflected particles of magnetic material.

The separating means comprise two horizontal rolls 16, 17 with reduced journals at their ends engaging bearings 19 on the horizontal bars 5 of the frame. The middle portions 20 of the rolls are of relatively large

diameter and of a length equal to about one-third the space between the sides of the frame, and the portions 21 between the ends of the middle portions 20 and the journals 18 are of less diameter. The middle portions 20 of the rolls have their peripheries longitudinally grooved to form teeth or projections 22 which are preferably made with one side radial and the other side chordal, as indicated in Fig. 4, so that downwardly-inclined surfaces will be presented to the granular mass as it passes between the rolls to prevent the particles from being mechanically held by the rolls. The ends of the rolls 16, 17 have at one end intermeshing gears 23 which are fixed thereto in such positions that the teeth or projections 22 may overlap as they pass the plane of the axes of the rolls without contacting. The journals 18 of the roll 16 is extended beyond the gear 23 and provided with a pulley 24 by which power is applied to drive the rolls. The corresponding journal on the other roll 17 is provided with a small sprocket wheel 25 which is connected by a drive chain 26 with a similar wheel 27 on the end of the distributing roller 13 to transmit motion to the latter. In order to protect the gears 23, sprockets 25, 27 and chain 26, from grit, they are covered by a sheet metal casing 28 secured by screws to the sheathing at the side of the frame.

The means for providing a magnetic field in the space between the middle portions 20 of the rolls consists in providing the respective reduced portions 21 of one roll with oppositely-wound coils 29 of electric conductor so disposed that upon the passage of current therethrough a positive consequent pole will be induced in the middle portion of the roll, and providing the respective reduced portions 21 of the other roll with oppositely-wound coils 29 of electric conductors so disposed that upon the passage of current therethrough a negative consequent pole will be induced in the middle portion of that roll, and by reason of the magnetic lines of force seeking the paths of least resistance they will pass from the positive to the negative pole across the space between the adjacent surfaces of the rolls. In order to insure the suppression of the magnetic lines of force on the non-adjacent surfaces of the rolls to thereby prevent any particles adhering after the teeth or projections have passed the lowermost points of their paths, I provide shields 30 of magnetic material which surround the remote halves of the central portions 20 of the rolls and support them from the end bars 3, 4 of the frame. The coils 29 on each roll are connected with each other and with contact rings 31 at the end of the roll by wires extending through the axis

of the roll, as indicated in dotted lines in Fig. 2.

The operation of the separator above described is as follows: Current having been turned on to the exciting coils 29 and the rolls 16, 17 caused to rotate in the direction of the arrows in Fig. 3, the hopper is supplied with the granular or powdered mixture. The mixture on coming in contact with the roller 13 is deflected sidewise so as to fall into contact with the upper portions of the roll sections 20 when the magnetic field is relatively feeble, but as it slides down over the slowly revolving teeth or projections 22 it is caused to tumble over and over, and at the same time the strength of the field increases until the plane of the axis is approached where the mixture is subjected to the strongest field and violently agitated by coming in contact alternately with the teeth 22 on the opposite rolls. Moreover, on account of the concentration of the magnetic lines of force at the edges of the teeth every particle of the granular substance which is magnetic even to the smallest degree is caused to attach itself and adhere to one or the other roll until it is carried out of the magnetic field of force when it is allowed to drop off into the compartment provided therefor; while the non-magnetic particles are allowed to fall perpendicularly from the teeth just below the plane of the axes of the rolls into their separate compartments 15.

I do not desire to restrict myself to the particular form or arrangement of parts herein described and shown, since it is apparent that they may be changed and modified without departing from my invention.

What I claim as new, and desire to secure by Letters Patent of the United States, is,—

1. In a magnetic separator, the combination of two magnetic rolls having peripheral teeth extending longitudinally thereof, and intermeshing gears fixed to said rolls and so disposed that the respective teeth on each roll will enter the spaces between the teeth of the other roll without contacting.

2. In a magnetic separator, the combination of two parallel magnetic rolls having peripheral teeth extending longitudinally thereof, each tooth being wedge-shaped and inclined downward relative to the field of force between the rolls, and means for rotating said rolls in unison with the said teeth out of contact.

In witness whereof I have hereunto set my hand this 8th day of December, 1904.

CHARLES M. GREEN.

Witnesses:

JOHN A. McMANUS, Jr.,
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