

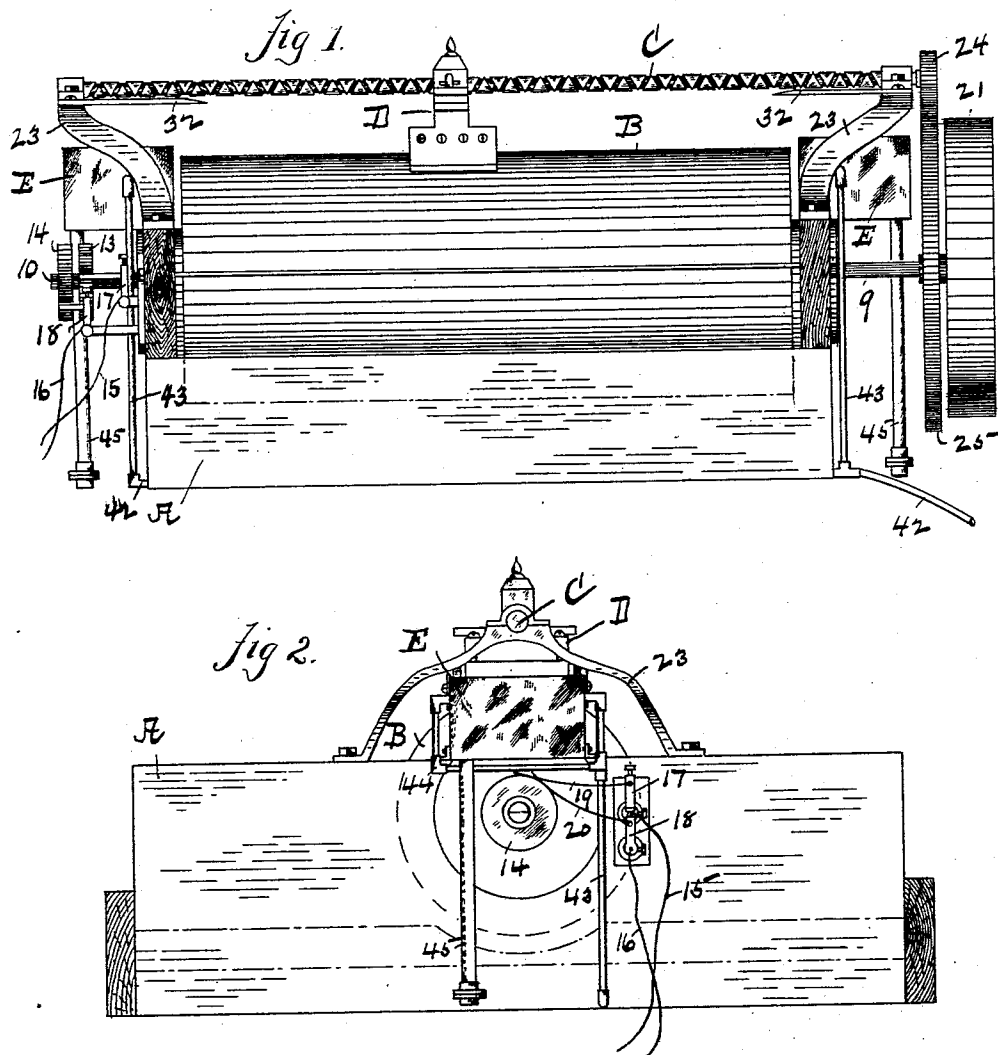
(No Model.)

2 Sheets—Sheet 1.

J. B. HAMILTON.
MAGNETIC SEPARATOR.

No. 572,162.

Patented Dec. 1, 1896.



Witnesses.
H. C. Frank.
J. E. Chapman

Inventor.
J. B. Hamilton
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Attorney.

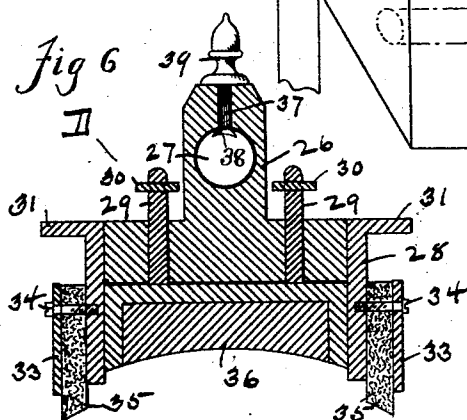
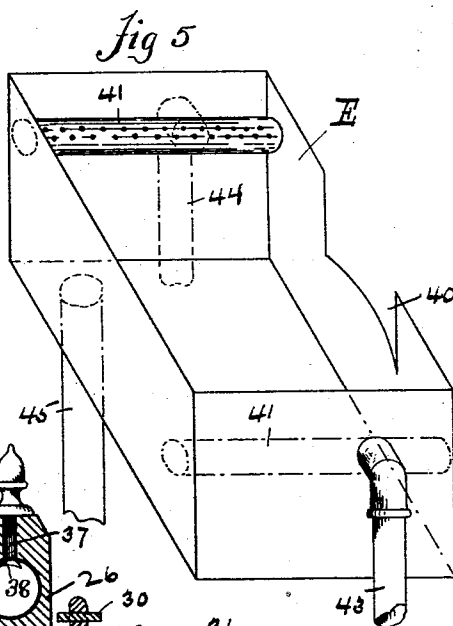
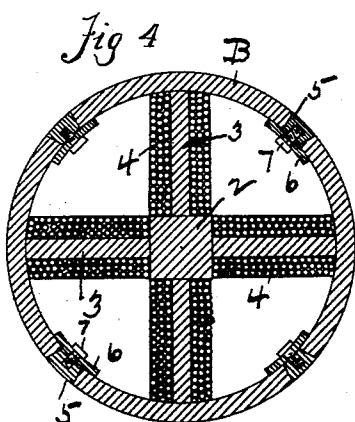
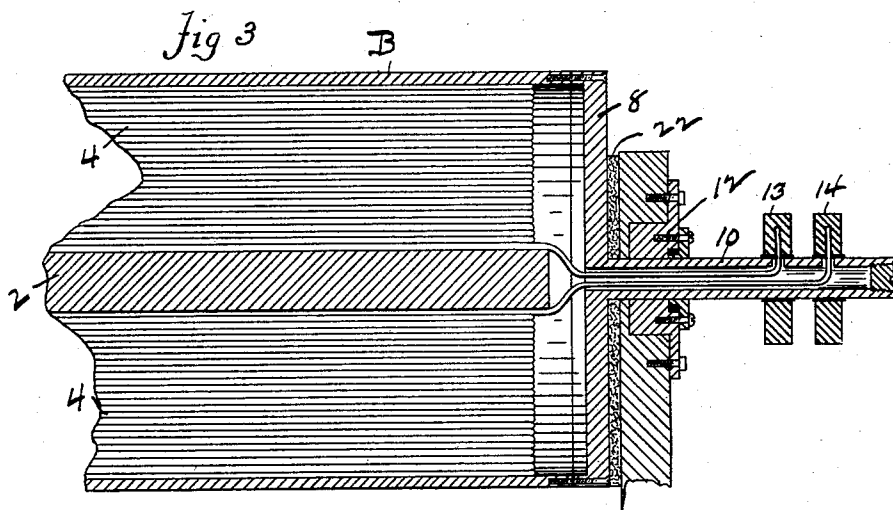
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2 Sheets—Sheet 2.

J. B. HAMILTON.
MAGNETIC SEPARATOR.

No. 572,162.

Patented Dec. 1, 1896.



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UNITED STATES PATENT OFFICE.

JOSEPH B. HAMILTON, OF SPRINGFIELD, MASSACHUSETTS.

MAGNETIC SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 572,162, dated December 1, 1896.

Application filed December 5, 1893. Serial No. 492,846. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH B. HAMILTON, a citizen of the United States, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented a new and useful Improvement in Magnetic Separators, of which the following is a specification, reference being had to the accompanying drawings, forming part thereof.

My invention relates to that class of devices for magnetically separating particles of iron from a mass of loose material in which the operating means consists of an electromagnetic roll or cylinder, and it has especial reference to devices of this class as applied to the removal of particles of iron from the semi-liquid pulp from which paper is made.

The objects of the invention are to provide an apparatus of this nature which will be of a simple and comparatively inexpensive construction; in which the revolving roll or cylinder will have a very powerful magnetic attraction; in which the roll or cylinder will be constantly cleaned by automatic means, and in which the particles of iron removed from the roll by the automatic cleaning mechanism will be automatically removed from the latter and prevented from reëntering the pulp.

To these ends my invention consists in the magnetic separator constructed and operating as hereinafter fully described, and particularly pointed out in the claims.

Referring to the drawings, in which like letters and numerals designate like parts in the several views, Figure 1 is an end view of an apparatus embodying the invention and a partial cross-section of the trough or chute in which it is located. Fig. 2 is a side elevation thereof, looking toward the right in Fig. 1. Fig. 3 is a partial longitudinal section of the roll. Fig. 4 is a cross-section thereof. Fig. 5 is a view, in perspective and drawn to a larger scale, of one of the spraying-boxes in which the roll-wiper is cleaned at each end of its traverse. Fig. 6 is a central cross-section of the wiper.

The letter A designates a trough or chute for conducting a flowing material, as, for example, the "sand-trap," through which pulp passes on its way to a paper-making machine,

and at some convenient point in which the apparatus devised by me is located.

The letter B designates the electromagnetic roll, which has a centrally-disposed longitudinal core 2 and four radially-disposed wings 3, preferably cast integral therewith, upon which wings are wound the four helices 4, of wire, extending longitudinally of the roll and nearly to each of its ends. I prefer to wind said four helices from a continuous wire, with the direction of the wind reversed upon each alternate wing, but do not restrict myself thereto. In its preferred form the shell of said roll will be slotted from end to end between each of the wings 3, the walls of said slots being made slightly diverging outwardly, and after the helices are wound said slots will be filled with strips 5, of brass or other non-magnetic material, as shown in Fig. 4, said strips having their sides beveled, as shown, and being securely retained in position by plates 6 near each end of the roll, which span the slots upon the inner side of the shell and are connected to the strips by screws 7. Said strips thus completely fill the slots in the shell and prevent the entrance of any moisture to the latter. By thus dividing the circumference of the roll into four equal parts, with non-magnetic divisions between them, I form four magnetic poles adjacent to said strips and equalize the powerful magnetic attraction of the roll about its circumferential surface in such manner as to practically obviate any neutral points thereon.

Heads 8 are secured to the ends of the roll, preferably by means of screws, as shown, with suitable interposed packing to prevent entrance of moisture to the helices, and said heads are provided with projecting trunnions 9 10, which have their bearing in the sides of the trough A, suitable stuffing-box devices 12 being provided to prevent the escape of the liquid material from the latter. The trunnion 10 is of tubular form to receive the ends of the wire forming the helices, which ends are connected, respectively, to disks 13 14 on said trunnion near its outer end, as shown in Fig. 3, the extreme outer end of the trunnion being plugged, as shown. The wires from the electrical generator are connected to binding-posts 17 18 on the side of the

trough, and brushes 19 20, extending from said binding-posts to the disks 13 14, respectively, serve to conduct the current to and from the ends of the wire forming the helices within the roll in a manner which will be obvious from an inspection of the drawings. A band-pulley 21, carried by the trunnion 9 of the roll, enables the latter to be driven by belt from a suitably-disposed counter-shaft.

The trough A is preferably provided with a transverse depression in its bottom, which is concentric with the roll, as indicated by broken lines in Fig. 2, and as the pulp or other material flows beneath the roll every iron particle contained therein is infallibly brought within the powerful magnetic field of the roll and is attracted to and retained upon the same until removed by the wiper presently to be described. A packing of felt or other suitable material is preferably interposed between the ends of the roll and the adjacent walls of the trough, as shown at 22, to prevent the passage of the flowing material at such points and compel it to pass beneath the roll.

The means devised by me for automatically cleaning the roll are as follows:

The letter C designates a screw-shaft journaled at its ends in brackets 23, secured to the top of the side walls of the trough, said shaft being parallel with and lying in the vertical plane of the axis of the roll. Upon said shaft is cut a double reversed thread, and at one end it carries a pinion 24, which meshes with a gear 25, carried by the trunnion 9 of the roll, whereby an accelerated motion is transmitted to the shaft from the roll.

The letter D designates the wiper, which is shown in cross-section in Fig. 6, and in its preferred form is composed of a block 26 of inverted T shape, having a hole 27 therein to receive the shaft C, and a frame 28, which loosely embraces the sides of said block and is provided with two studs 29, which pass upwardly through holes in the block in such manner as to afford to the frame a limited vertical movement upon the latter, while pins 30, inserted in the upper ends of said studs, prevent the frame from dropping entirely away from the block. At its upper end said frame is provided with the oppositely-projecting flanges 31, which are adapted to be engaged by inwardly-projecting guide-bars 32 on the brackets 23 as the wiper approaches the end of its movement in either direction to afford vertical support to the frame and keep its under side in horizontal alinement with the surface of the roll. To the opposite sides of said frame are secured, by means of bearing-plates 33 and screws 34, strips of felt 35 or other suitable material adapted to exert a wiping action upon the surface of the roll and the lower edges of which are beveled to conform substantially to the curvature of the circumference of the roll. To the under side

of said frame, between the strips 35, is secured a piece of iron or steel 36, preferably having its under side curved to correspond with the surface of the roll, which by responding to the magnetic attraction of the roll causes the wiping-strips to bear with considerable pressure upon the surface of the latter to insure the thorough cleaning of the same. The block 26 is provided with a small hole extending from the hole 27 to its upper end, which is tapped near its outer end, and within said small hole is located the shank 37 of a dog 38, which operatively engages the thread of the screw-shaft, a set-screw 39 at the outer end of said hole preventing upward movement of said dog, while permitting it to have the slight rocking movement necessary to enable it to follow the reversed thread of said shaft. As shown, the set-screw 39 has a head of ornamental shape.

The action of the screw-shaft upon the wiper causes the latter to travel back and forth from end to end of said shaft, thereby causing the strips 35 to remove from the surface of the roll B all particles of iron lodged thereon, and to prevent said particles from again entering the pulp or other material flowing through the trough I effect a washing movement of the wiper at one or both ends of its movement, preferably the latter, and for this purpose I locate spray-boxes E E upon the side walls of trough A, beneath the ends of the screw-shaft. Said boxes, one of which is shown enlarged in Fig. 5, are open at the top and are provided with a recess in their inner side wall, through which the lower portion of the wiper passes in entering and leaving the box. At each end of the box is located a perforated pipe 41, to which water is preferably supplied as follows: A supply-pipe 42, leading from any source of water under moderate pressure, extends beneath the trough A, and from said pipe extend the pipes 43, leading to the pipes 41 at one end of the boxes E, while branch pipes 44 lead from said pipes 43 to the pipes 41 at the opposite ends of said boxes. The water thus supplied to the pipes 41 issues therefrom in a series of jets which engage the wiper from opposite directions as the latter is carried into and out of the box in such manner as to wash therefrom all particles of iron and accumulations of pulp lodged thereon, which latter fall to the bottom of the box and thence escape through waste-pipes 45, leading from the boxes, and are thus prevented from reëntering the flowing material.

The operation of the apparatus thus constructed is as follows: The roll B being so connected with a power-shaft through its band-pulley 21 and a belt as to cause to said roll a slow revolving movement in a direction opposite to that of the flow of the liquid material through trough A, and the electrical connections between said roll and a generator being established, as described, every iron

particle contained in said flowing material will be attracted to and retained upon the surface of the roll, while at the same time no obstruction to the flow of said material is offered by the roll. By its described connection with the roll-trunnion the screw-shaft C is given a considerably-accelerated motion, which carries the wiper D back and forth in such manner as to cause it to wipe from the surface of the roll all of the iron particles and accumulations of pulp, should there be any lodged thereon. While said wiper is over the roll its frame 28 is drawn toward the latter by the magnetic action of the piece of metal 36, so as to secure a thorough wiping of the surface of the roll by the strips 35, any unevenness in the bearing-faces of said strips being compensated for by the freedom of the frame to have a limited vertical movement upon block 26. As the wiper is about to pass beyond the end of the roll at either end of its traverse the flanges 31 on frame 28 are carried upon the guide-bars 32 of brackets 23, by which the wiper is steadied in its further movement and is truly guided upon the end of the roll in its return movement. As soon as the wiper leaves either end of the roll it enters one of the spray-boxes E, and the strips 35 are thoroughly washed by the jets of water from the pipes 41, so that they are perfectly clean when they again engage the roll upon their return movement. Whenever said strips 35 become worn to such an extent as to impair their wiping action, new strips can be substituted therefor by simply removing plates 33 and screws 34 without disturbing any other parts of the apparatus. As hereinbefore stated, a single spray-box to wash the wiper at one end of its traverse merely can be used, if desired, but I prefer to use two, as shown, and thereby insure the thorough cleansing of the wiping-strips preparatory to their traverse across the roll in either direction.

It will be noted that the apparatus herein described is adapted to take entire care of itself and requires no attention other than to see that the electrical connections remain unbroken. By its use the removal of all iron particles from the pulp or other material is assured. The apparatus, moreover, is extremely simple and inexpensive in its construction as compared with most of those now in use for the purpose, and yet is less liable to get out of working order or to need repairs.

It will be obvious that the automatic cleaning mechanism devised by me is adapted for use in connection with any form of electromagnetic roll or cylinder, and I do not wish to restrict its use to the particular form of roll herein shown and described. It will be obvious also that various changes and modifications in the details of construction herein shown and described can be made within the spirit of my invention.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a magnetic separator, the combination with an electromagnetic roll or cylinder, of a wiper adapted to be held in contact with said roll or cylinder by magnetic attraction, and means for imparting movement to said wiper longitudinally of the roll or cylinder, substantially as set forth.

2. In a magnetic separator, the combination with an electromagnetic roll, of a wiper bearing against the surface of said roll, means for imparting to said wiper a reciprocatory movement longitudinally of the roll, and means for directing a jet of water against said wiper, at one end of its traverse, to clean the same, substantially as set forth.

3. In a magnetic separator, the combination with a trough or chute for conducting a flowing material, of an electromagnetic roll journaled at its ends in the sides of said trough, a screw-shaft supported adjacent to said roll and lying parallel with the axis thereof said screw-shaft having a double-reversed thread which at one end extends beyond the end of the roll, a wiper operatively engaging the thread of said shaft and bearing against the surface of said roll, and means for revolving said roll and shaft at different speeds, substantially as and for the purpose set forth.

4. In a magnetic separator, the combination with an electromagnetic roll, of a wiper bearing against the surface of said roll, a screw-shaft operatively engaging said wiper and adapted to move it longitudinally of said roll and beyond the end of the latter, and a spray-box located adjacent to the end of said roll and containing water-jet devices as described, into which box said wiper is carried by its operating-shaft when it leaves said roll, substantially as and for the purpose described.

5. In a magnetic separator, the combination with roll B, of screw-shaft C, and wiper D, said wiper consisting of block 26 operatively engaging the thread of said shaft, frame 28 capable of a limited vertical movement upon said block, and wiping-strips 35 and magnetic part 36 carried by said frame, substantially as set forth.

6. The combination with a trough or chute, as A, of an electromagnetic roll, as B, revolvably supported transversely of said trough, wiper D bearing against the surface of said roll, screw-shaft C operatively engaging said wiper and adapted to carry it beyond the ends of said roll, and means, as the guide-bars 32, for guiding the wiper in its movement after it leaves the ends of the roll, substantially as set forth.

7. The combination of the roll B, wiper D, and screw-shaft C for operating the latter, of a spray-box E located adjacent to the end of

said roll, perforated pipes 41 located in said box and pipes 42 43 and 44 for supplying water thereto, substantially as set forth.

8. The combination with the electromagnetic roll B provided with trunnions 9 10 and carrying band-pulley 21 and gear 25, of the screw-shaft C carrying pinion 24 which meshes with said gear 25, wiper D operatively

connected with said screw-shaft, and means, as the guide-bars 32, for holding the wiper 10 from rotation when it passes beyond the ends of the roll substantially as described.

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