(No Model.) 2 Sheets—Sheet 1.

F. H. RICHARDS.

MAGNETIC SEPARATOR.

No. 467,833. Patented Jan. 26, 1892.

Fig. 1

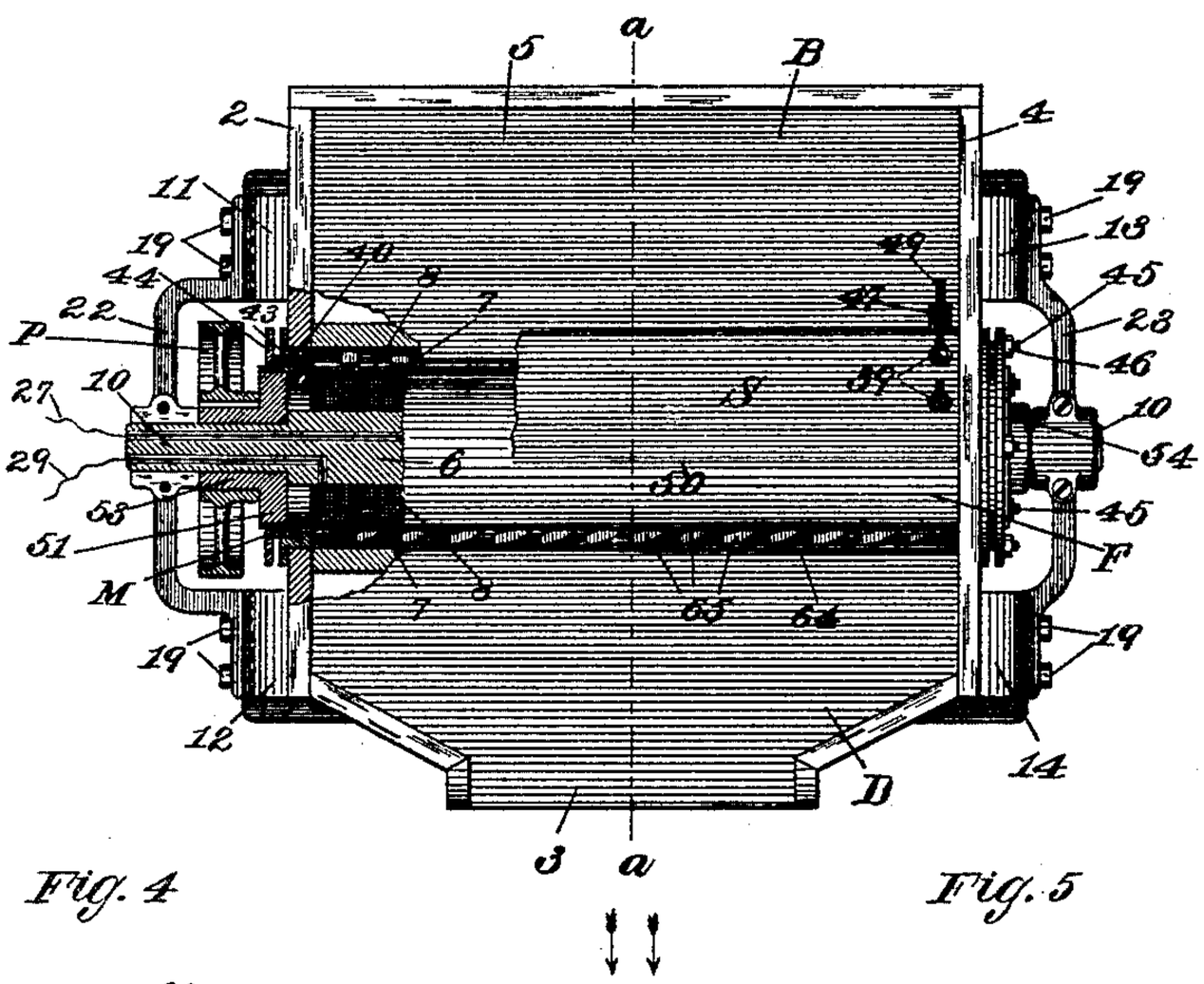


Fig. 4

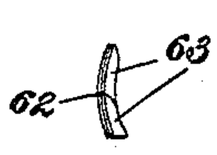


Fig. 5

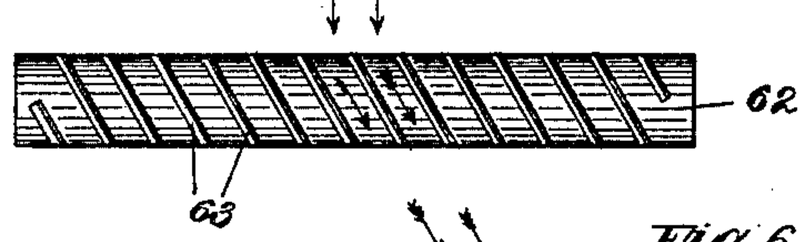


Fig. 6

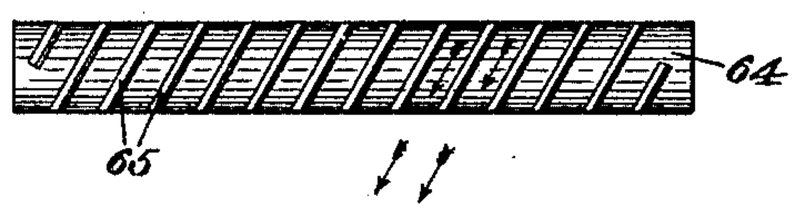


Fig. 8

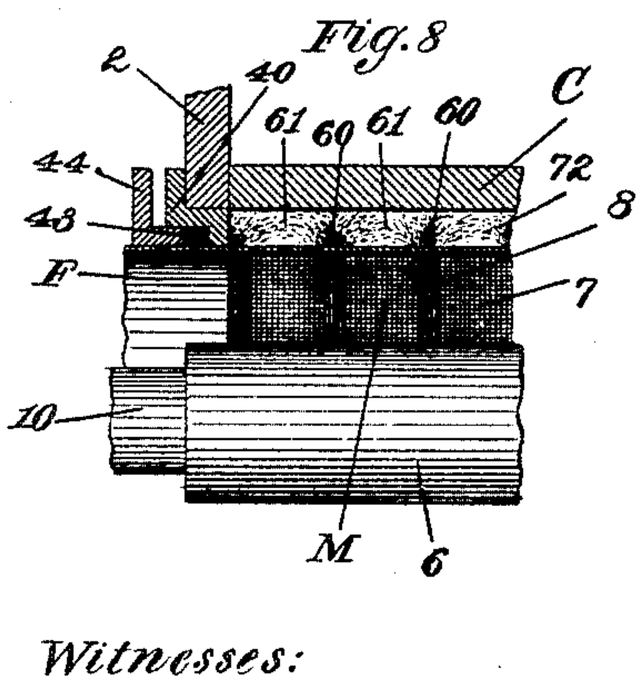
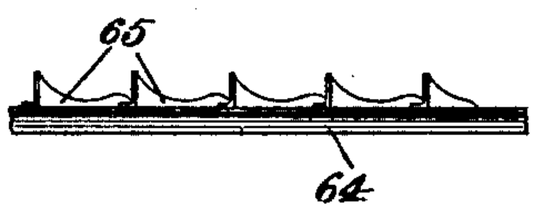


Fig. 7



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(No Model.) 2 Sheets—Sheet 2.

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MAGNETIC SEPARATOR.

No. 467,833. Patented Jan. 26, 1892.

Fig. 3

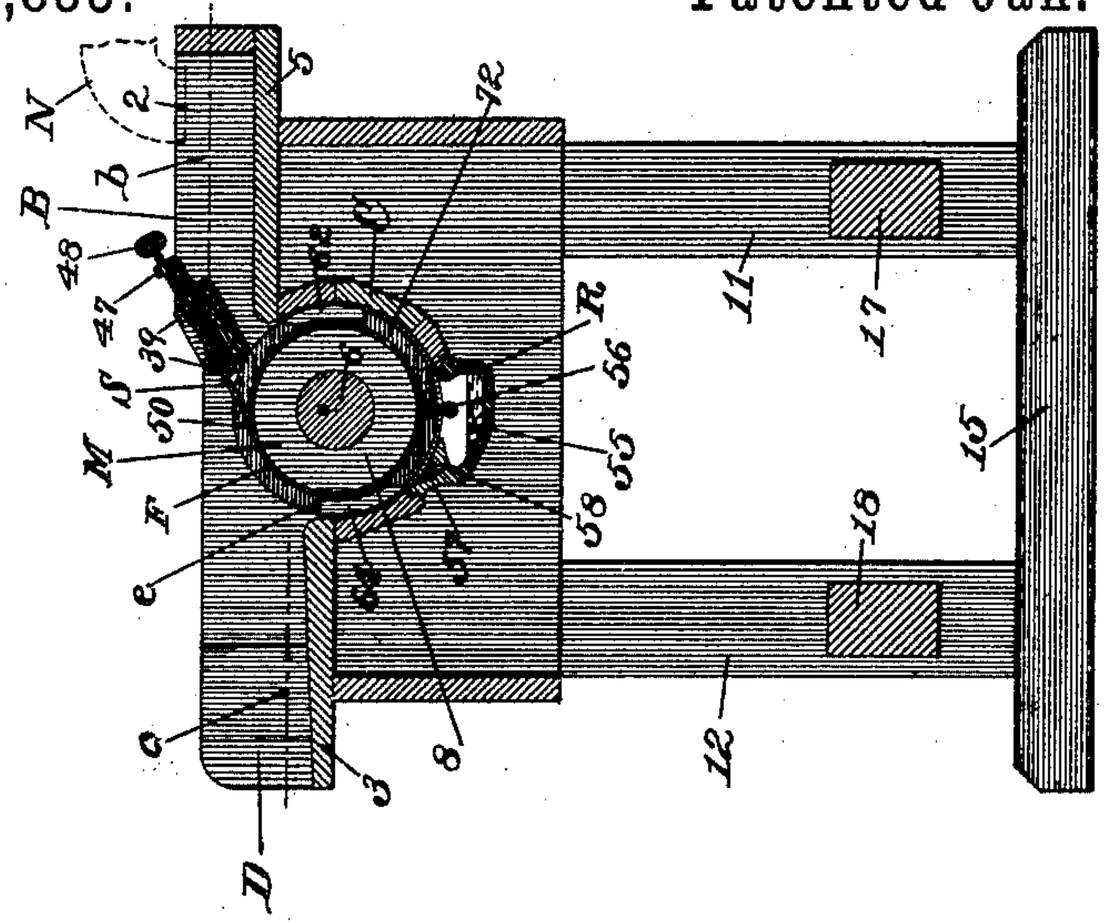
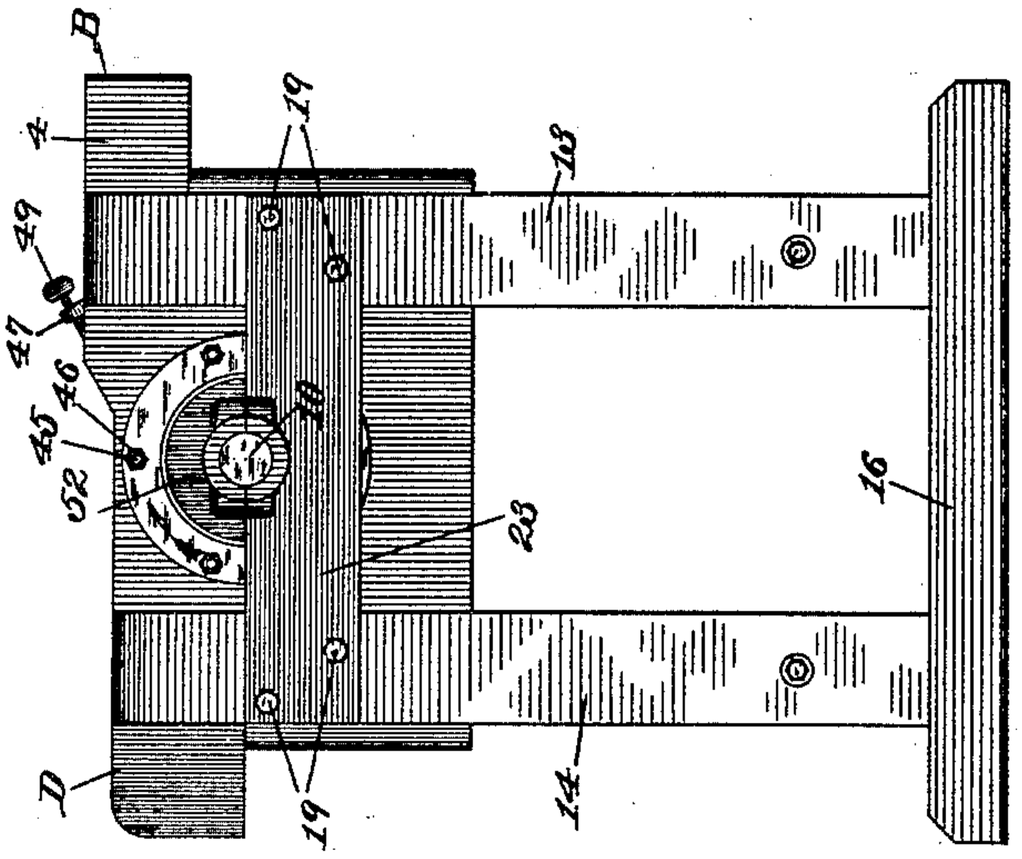


Fig. 2



Witnesses:
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UNITED STATES PATENT OFFICE.

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MAGNETIC SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 467,833, dated January 26, 1892.

Application filed September 29, 1891. Serial No. 407,202. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS H. RICHARDS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Magnetic Separators, of which the following is a specification.

This invention relates to that class of magnetic separators especially intended for separating particles of iron from such fluids as paper-pulp and the like.

The object and nature of the invention are hereinafter more fully set forth.

In the drawings accompanying and forming a part of this specification, Figure 1 is a plan view of a pulp-separator embodying my present improvements. Fig. 2 is an end elevation of the same as seen from the right hand in Fig. 1. Fig. 3 is a sectional elevation in line *a a*, Fig. 1. Figs. 4, 5, 6, and 7 are detail views of the current-deflectors. Fig. 8 is a sectional view similar to a portion of Fig. 1, illustrative of certain features of my invention.

Similar characters designate like parts in all the figures.

The apparatus consists of a suitable frame-work and tank, which may be constructed of metal or, as supposed to be shown in the drawings, of wood, which in practice may be lined with sheet metal after the manner of lining the tanks and troughs ordinarily used in paper manufactories.

A suitable form of separator-tank may consist of the supply-box B, the receiving-box D, and the magnet-case C, all supported by suitable frame-work. Said tank may be suitably constructed as follows: The end walls 2 and 4 are fixed to the posts of the frame-work and form the ends of said supply and receiving boxes. The sides 2 and 4 are connected by the floor 5 of the supply-box B, the floor or apron 3 of the receiving-box D, and the magnet-case C. These several parts are all to be firmly united by screws or other fastenings in a manner well known to mill-wrights. As shown in the drawings, said tank is mounted on four posts 11, 12, 13, and 14, which rest on the two sills 15 and 16 and are connected together longitudinally of the machine by the beans 17 and 18, all being held together by suitable bolts or fastenings. The side walls 2 and 4 are perforated concentrically of the magnet-case C for the passage through said walls of the shell or case F, within which is located the magnet, (designated in a general way by M.)

The magnet M consists in its preferred form of a central core 6, having thereon coils of wire 7, interspersed between soft-iron rings, as 8, the whole being contained in a revolving non-magnetic shell or tube F, extending over the entire length of the magnet proper. The magnet M is in practice of high power to draw the magnetic particles through a considerable distance. Said shell or tube F may be made of suitable metal, as brass or copper, or of other suitable non-magnetic material, as hard rubber or the like. Incidentally said tube F has also the advantage when made of brass or copper of being substantially non-corrosive by the action of the paper-pulp. For supporting said magnet the aforesaid core 6 is extended on either end thereof to form supporting-journals, as 10, whereby the magnet is supported on the bearing-beams 22 and 23, respectively, which beams may be fixed, substantially as shown, to the frame-work of the apparatus by the screws 19. The solid metal ends or heads 51 and 52 of the tube F are provided with hubs 53 and 54, respectively, which hubs are bored to receive the reduced outer ends of the core 6 of the magnet on which the said tube or casing is journaled. The hub 53 has fixed thereon a driving-wheel P, by means of which and a suitable driving-belt (not shown) said casing F may be slowly revolved about said magnet M in the direction indicated by the arrow in Fig. 2.

For preventing leakage around the ends of the magnet-casing F the ends thereof are provided with stuffing-boxes, which, being substantially duplicates, a description of one of them will suffice for a description of both. In Fig. 1, at the right hand thereof, said stuffing-box is shown in top view, while at the left hand of said figure said box is shown in horizontal section. Said box consists of an

annular frame 40, which is fitted into the end wall of the tank and is affixed thereto by means of screws or other suitable fastening devices. On its inner side said stuffing-box frame 40 is shaped, substantially as shown, to receive the packing material 43 and the gland 44 for compressing the packing material. For adjusting the gland the stuffing-box is provided with the screws or bolts 45 and nuts 46, operating in the usual manner. The pressure or "head" of the paper-pulp being comparatively slight, (usually not over one foot in greatest depth in the tank,) of course the packing material need not be greatly compressed, and consequently will not cause much resistance to the rotation of the casing F.

For collecting the substances adhering to the casing a scraper S is provided at the top of said casing and is set inclined thereto, so that its forward edge 50 forms a knife-edge bearing on the surface of the said magnet-incasing shell. It may be supported in the frame by brackets, as 47, fixed to the tank and provided with thumb-screws 48 and 49 for forcing down the scraper-blade, said blade being held in place by the binding-screws 39, which pass through slots in the blade in a well-known manner.

For abstracting particles of brass and other non-magnetic metals—as, for instance, pieces of buttons—that may have been ground up with the rags from which the paper-pulp is made, I have provided a reservoir R, preferably constructed of glazed earthenware or other material impervious to mercury. As shown in Fig. 3, said reservoir is fitted into the magnet-case C below the magnet, and, as illustrated in said figure, is partially filled with mercury 55. A deflector or wall 56 is fixed to the end walls 2 and 4 of the tank to direct the pulp-current downward against the mercury at 55. The particles of non-magnetic metals being heavier than the pulp naturally sink to the bottom and are amalgamated and collected by the mercury. As the paper-pulp flows on it may carry with it some small portion of the mercury, and to catch this I have formed in the reservoir R a groove or chamber, as 57, having suitable passages, as 58, leading therefrom back to the main chamber of the reservoir, through which passages the particles or globules of mercury carried up may flow back into the reservoir.

Magnets of the form herein shown and described, consisting of a central core having alternate bands or zones of wire and metal plates, must necessarily have corresponding zones of weak and strong magnetic attraction, as illustrated in Fig. 8 of the drawings, wherein the darker shading at 60 indicates one of the stronger magnetic zones, and the lighter shading at 61 indicates one of the weaker zones. Should the pulp-current flow continuously in a straight course—*i. e.*, in the same vertical plane—through the machine, it is obvious that a portion of the pulp would come under the influence of the strong magnetic zones, while other portions would come under the influence of the said weaker zones only. It is evidently desirable that all the paper-pulp passing through the machine be acted upon by the magnet in the most effective way, and to accomplish this I provide one or more sets of pulp-current deflectors, which operate to turn the course of the pulp-current, so that during some portion of its passage about the magnet each particle of pulp flows across some one of the strong magnetic zones thereof, and all the pulp is thus thoroughly treated. This feature of my invention is illustrated in Figs. 5 and 6, in which figures the dotted lines and arrows show the course of the pulp-current as directed by the said deflectors, respectively. Said deflectors consist in their preferred form of thin metal plates, as 62 and 64, fixed to the inner side of the magnet-case and having fixed thereon in any convenient manner series of ribs, as 63 and 65. The ribs 63 are mounted on the concave inner side of said plates, and are set at an angle on the plate 62, so as to guide the pulp-current toward the right hand in said Figs. 5 and 6, and the ribs 65 are set at an opposite angle on the plate 64 and operate to direct the course of the pulp-current toward the left hand in said figures, as illustrated by the aforesaid arrows. The fixed deflector-plates project from the magnet-case toward the magnet-tube, (but should not quite touch said tube,) so as to act upon the whole body of pulp flowing through the magnet-case.

In using the apparatus, the magnet-tube being revolved, as aforesaid, in the direction of the arrow in Fig. 2, the paper-pulp is delivered into the tank through a pipe or conduit, as N, Fig. 3, into the rear or supply-box of the apparatus, which fills, for instance, up to the line *b*. Flowing forward, the pulp is stopped by the scraper, (which acts as a front end for the receiving part of the tank,) then passes down into the magnet-case and follows around the same contiguous to the magnet, all the time being subject to the powerful attraction of the magnet, which, during said passage, has ample time for attracting to itself any particles of iron or steel which may be floating in the pulp. During its passage around and underneath the magnet the pulp strikes the deflector-wall 56 and is deflected downward against the mercury in the reservoir R, which amalgamates or absorbs the particles of brass or other non-magnetic particles in the pulp. The pulp now continues on its course about the magnet-tube, and arriving at the point *e*, Fig. 3, flows out over the bottom 3 of the discharge-spout D, rising in practice to about the line *c*. The difference in height between the lines *b* and *c* indicates the head or pressure acting to force the pulp through the circular passage around the magnet. During the first part of its passage about the magnet the pulp strikes the current-deflectors 63 and its course is directed toward the right hand in Fig. 1 longi-

tudinally of the magnet for the purpose hereinbefore set forth, and during the latter part of its passage about said magnet (when a second set of deflectors is used) it strikes the deflectors 65 and is again diverted in its course, this time toward the left hand in said Fig. 1. The passage 72 is made of relatively small thickness, substantially as shown, so as to bring all the pulp into sufficiently close proximity to the magnet. The movement of the magnet-tube being in the same direction as the flow of pulp around said tube, the flow of pulp does not so strongly tend to dislodge any material magnetically held thereto.

Having thus described my invention, I claim—

1. In a magnetic separator, the combination, with a frame-work and with a magnet having alternating strong and weak fields or zones, there being a pulp passage-way between the frame-work and magnet, of one or more sets of deflectors located adjacent to the magnet in said passage-way and acting to laterally deflect the current therein, whereby the fluid acted upon is directed from the weak toward the stronger field or zone, substantially as set forth.

2. In a pulp-separator, the combination, with a cylindrical magnet, substantially as described, having alternate weak and stronger fields or zones, there being a pulp passage-way between the frame-work and the magnet, of two sets of pulp-deflectors, substantially as described, located at successive points in said passage-way adjacent to the magnet and set in reverse directions, substantially as set forth.

3. In a magnetic separator, the combination, with a frame-work, substantially as described, constructed to receive the horizontal cylindrical magnet and having the pulp-channel around and underneath said magnet, of the mercury-reservoir R, located underneath the magnet and opening into said channel, and the deflector 56, contiguous to the under side of the magnet and depending into said reservoir, substantially as set forth.

4. In a magnetic separator, the combination, with the magnet and the frame-work having the passage around and underneath the magnet, of the mercury-reservoir underneath the magnet and communicating with said passage, and the channel 57, forward of the reservoir R and communicating with the passage-way and with the reservoir, substantially as set forth.

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