Oct. 5, 1943. C. A. RIETZ 2,330,995

MAGNETIC APPARATUS FOR REMOVING TRAMP IRON

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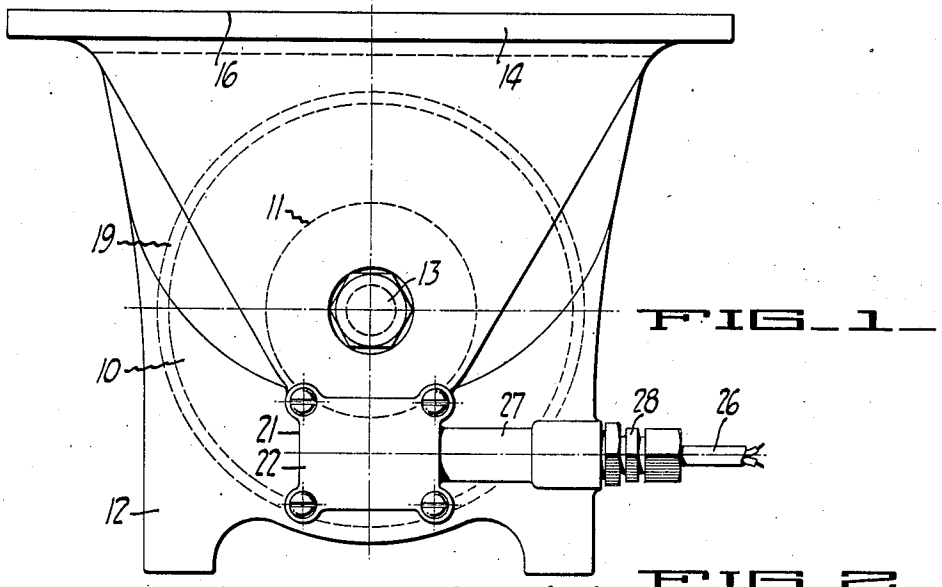


FIG_1_

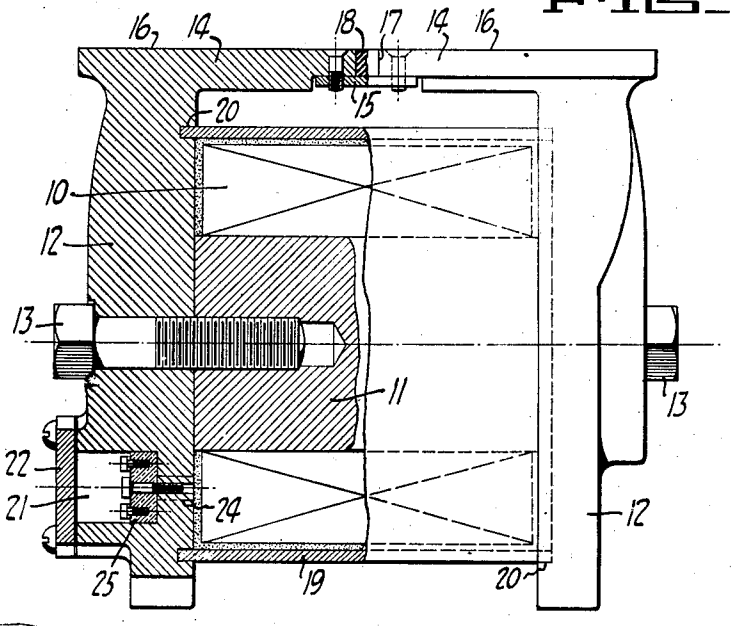


FIG_2_

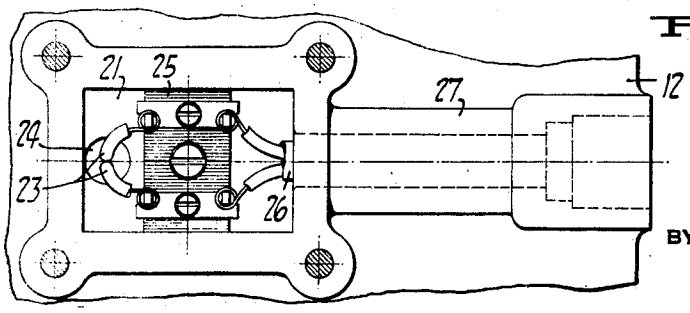


FIG_3_

INVENTOR
Carl A. Rietz
BY Paul O. Fleher
ATTORNEY

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FIG_4_

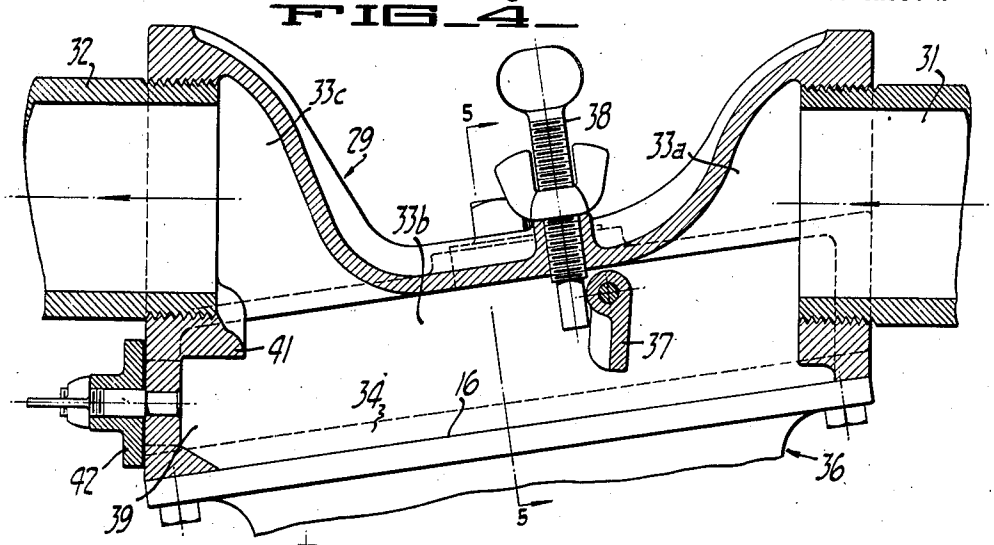


FIG_5_

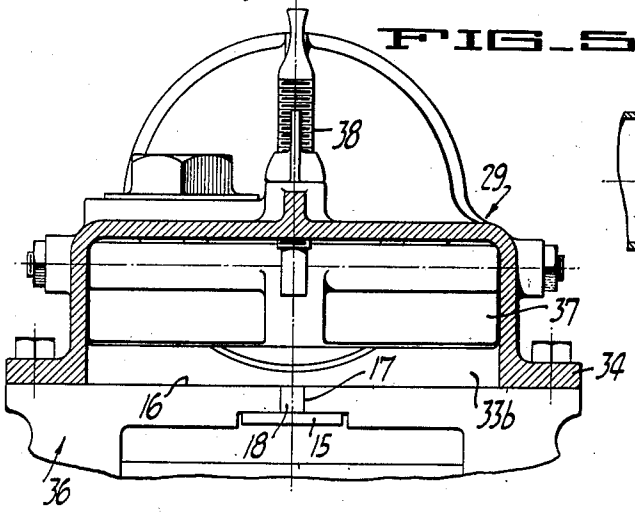


FIG_6_

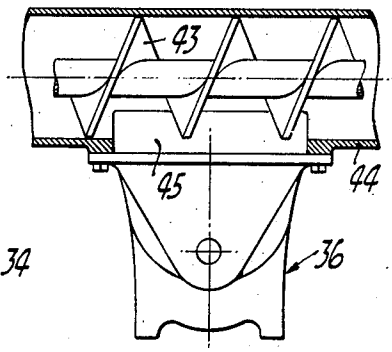


FIG_7_

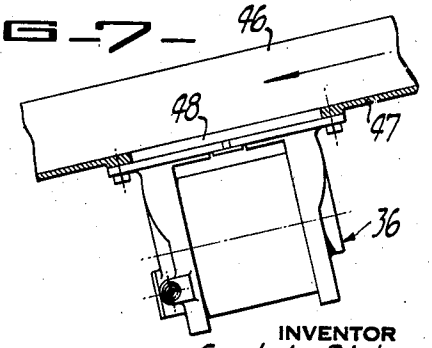
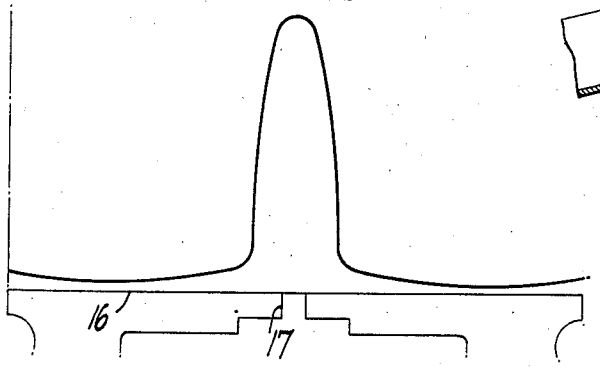


FIG_8_



INVENTOR
Carl A. Rietz
BY Paul D. Fleck
ATTORNEY

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2,330,995

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MAGNETIC APPARATUS FOR REMOVING TRAMP IRON

Carl A. Rietz, San Francisco, Calif.

Application August 2, 1940, Serial No. 349,661

1 Claim. (Cl. 209—223)

This invention relates generally to apparatus for the purpose of removing so-called "tramp iron" from various wet materials.

In many instances, as for example in the canning industry and in various fruit processing plants, stray fragments of iron or so-called "tramp iron" finds its way into the material being processed. In the past it has been attempted to remove such tramp iron by use of settlement traps in the various conveying conduits, launders, or screw conveyors, but it has been found that such expedients do not insure complete removal. Magnetic devices have not been utilized for this purpose, presumably because no such magnetic devices have been available which have been capable of withstanding continued subjection to water, and which have been capable of tramp iron removal more effectively than ordinary settlement traps. In this connection it should be noted that removal of tramp iron from wet materials, such as slurries or pastes, is not the same as the removal of tramp iron from dry divided materials. In the case of dry divided materials, it is a comparatively simple matter to apply a conventional electromagnet to a free falling stream of the material, whereby tramp iron or magnetic fragments are separated out. In wet slurries or pastes there is a tendency for small fragments of iron to be carried along with the stream of material, and the stream of material may be of a substantial depth.

It is an object of the invention to provide a practical form of apparatus making use of a magnetic device, which will effectively and positively remove tramp iron from wet materials.

Another object of the invention is to provide a magnetic device for the above purpose which will be absolutely liquid tight, and which therefore can be subjected to wet materials without danger of deterioration or interruption of service.

Additional objects of the invention will appear from the following description in which the preferred embodiment of the invention has been set forth in detail in conjunction with the accompanying drawings.

Referring to the drawings:

Figure 1 is a side elevational view illustrating a magnetic device incorporating the present invention;

Figure 2 is an end view of the device shown in Figure 1, with certain parts being broken away and in cross section;

Figure 3 is an enlarged detail illustrating the manner in which terminals from the magnetic winding are connected to the current supply conductors;

Figure 4 is a side elevational view of apparatus making use of the magnetic device of Figures 1 and 2 for removing tramp iron from a liquid flow;

Figure 5 is a cross sectional detail taken along the line 5—5 of Figure 4;

Figure 6 is a cross sectional detail illustrating apparatus where the wet material is being conveyed by means of a feed screw;

Figure 7 is a side elevational view, partly in cross section, illustrating apparatus incorporating an open launder for flow of the material being treated; and

Figure 8 is a curve illustrating the type of magnetic field produced by my magnetic device.

Referring first to Figures 1 to 3 inclusive, the magnetic device illustrated comprises a winding 10, adapted to be connected to a suitable source of direct current. This winding surrounds a magnetic core 11, the ends of which engage the side magnetic legs 12. This assembly is held together by the studs 13 which are threaded into the core. The magnetic pole pieces 14 are formed integrally with the side legs 12, and these pole pieces have coplanar flat surfaces 16, forming virtually a flat table for the device. Adjacent parallel edge portions 17 of the pole pieces 14 are shown separated by the strip 18 of resilient rubber. A plate 15 of non-magnetic material is attached to the underside of the pole pieces, and aids in retaining the rubber strip 18 in proper position.

The construction and proportioning of the parts of the magnetic device are such as to afford a relatively intense magnetic field, with the magnetic flux being concentrated in the vicinity of the magnetic gap between the pole portions 17. To attain this object, it will be noted that the side legs 12 have thickened medial portions where they engage the ends of the core 11. Arrangement of the pole pieces 14 in a common plane with a relatively narrow magnetic gap minimizes flux leakage, and concentrates all of the flux between the pole portions 17.

It is important that the magnetic device be immune to contact with moisture. In order to make the device absolutely waterproof, the winding 10 is surrounded by a cylindrical metal shell or tube 19 of non-magnetic material such as aluminum or aluminum alloy. The inner opposed faces of the magnetic legs 12 are provided with annular recesses 20 to accommodate the end edges of the shell 19. In assembling the device,

the shell 18 is first assembled with respect to one of the side legs 12, with the open end of the shell uppermost. With the winding 10 within the shell, the shell is filled with a suitable hot molten bitumastic sealing compound which will solidify at normal room temperatures. The other magnetic leg is then applied and the remaining stud 13 screwed down. The amount of bitumastic sealing compound is such that as the parts are being thrust to final position, all air within the shell 19 and surrounding the winding 10 is expelled, and a small amount of the bitumastic is extruded through the recesses 20. Thus the interior of the device is absolutely sealed against penetration of moisture, even though the device may be immersed in liquid.

A waterproof connection to the winding 10 can be made as shown in Figure 3. In this case a small outlet box 21 is formed integral with one side leg 12, and is normally sealed by cover 22. Terminal wires 23 from the winding 10 extend through opening 24 in the side leg, and are attached to the terminal block 25. A flexible rubber covered conductor cord 26 extends into the box 21, through sleeve 27, and has its conductors connected to the block 25. Leakage between sleeve 27 and the cord 26 is prevented by the packing gland 28.

Figures 4 and 5 illustrate apparatus making use of the magnetic device of Figures 1 to 3 inclusive, where it is desired to remove tramp iron from a flow of liquid material occurring through pipes or conduits. In this case a casing 29 of nonmagnetic material has an inlet connected to the pipe 31, and an outlet connected to pipe 32. The interior of the casing affords a passage for flow of material between the pipes 31 and 32, and this passage includes an inlet portion 33*a*, an intermediate flattened portion 33*b*, and an outlet portion 33*c*. The lower side of the casing 29 is provided with the inclined flange 34, to which the magnetic device 36 is secured. This magnetic device is the same as that described with reference to Figures 1 to 3 inclusive. Thus the flat surface 16 of the magnetic device, with the exception of the edge portion which is secured to flange 34, is directly exposed to the flow of material through the casing 29. Within the intermediate passage portion 33*b*, there is a hinged gate 37, the position of which can be adjusted by means of screw 38. Material is forced to pass below the free edge of gate 37, or in other words through the restricted orifice formed between the free end of the gate and the adjacent flat surface of the magnetic device 36. Thus the thickness of the stream of material being subjected to the magnetic action can be adjusted as desired, depending upon the viscosity or fluidity of the material.

In the outlet portion 33*c* of the passage through casing 29, a trap space 39 is formed below the level of pipe 32, in which tramp iron may be retained by magnetic attraction and settlement. A deflector 41 extends generally over the trap space 39 in order to prevent carrying material into the outlet pipe 32 by relative rapid fluid flow. Material can be removed from space 39 by removing the end closure 42.

The apparatus described above in connection with Figures 4 and 5 will effectively remove all tramp iron from various liquid materials or pulps, even though the flow rates may be relatively high. Forcing the material to pass beneath the gate 37 spreads the flow into a relatively flat stream which passes over the poles of the magnetic device, thus making certain that tramp iron is brought sufficiently close to the pole pieces to insure retention. To clean the apparatus of accumulated tramp iron, it is only necessary to disconnect the closure plate 42, or the magnetic device is removed from the flange 34.

Figure 6 illustrates how the magnetic device of Figures 1 and 2 can be incorporated in apparatus where a wet pulp or paste is being conveyed by means of a feed screw. In this case I have shown a conventional feed screw 43 disposed within an ordinary feed screw casing 44. A portion of the lower side of the casing 44 is cut away to provide the opening 45, and this opening is closed by the magnetic device 36. It will be evident that the flights of the feed screw will cause the material to be passed directly over the pole pieces of the magnetic device 36, so that the material being conveyed will be subjected to the intense magnetic field, and tramp iron will be separated out and retained upon the pole pieces.

Figure 7 indicates the apparatus making use of the magnetic device 36 in conjunction with an open launder 46. In this case the bottom flat wall 47 of the launder is provided with an opening 48, and this opening is normally closed by the pole pieces of the magnetic device 36. In this instance the magnetic gap between the pole pieces is arranged at right angles to the flow of material, so that the magnetic field effectively acts upon the full width of the flow stream. Here, again, any fragments of iron or other magnetic material carried by the stream of material are separated out by the magnetic pull and are retained by the pole pieces of the magnet.

As previously pointed out, the magnetic device is constructed to exert a relatively strong magnetic pull upon tramp iron. This pull is strongest in regions adjacent the magnetic gap between the pole portions 17. The curve of Figure 8 illustrates generally the distribution of magnetic flux above the pole pieces. It will be noted that for regions adjacent the pole portions 17, the magnetic flux is relatively intense, while over the remainder of the pole pieces it is relatively weak. Actually with a magnet constructed as described, and consuming approximately 105 watts direct current, the pull upon the end of a square bar measuring one inch square, and spanning the pole portions 17, is in the neighborhood of from 100 to 110 pounds. For areas displaced about ⅜ inch to one side of the magnetic gap, the pull upon the same bar falls to about from 6 to 7 pounds. Such a magnetic device has been found effective for removing tramp iron from streams of material of about 2 inches or less in depth. The actual width of the magnetic gap in this particular instance was about ⅜ inch, or in other words a minor fraction of the depth of the stream of material for which the device was suitable. The top surface of the device, including both pole pieces, measure about ten inches square.

The bulging of the magnetic legs as previously described contributes towards producing the desired intense magnetic field in the vicinity of the pole portions 17. Specifically, the cross sectional area afforded for the bulged middle portions of legs 12 is made substantially greater than the cross sectional area of the core 11. Also the cross sectional area afforded at the point of junction between the side legs 12 and the pole pieces 14 is substantially greater than the cross sectional area afforded by the intermediate portions of the legs 12. This proportioning has the effect of concentrating the magnetic flux

between the pole portions 17, and minimizing magnetic leakage between other portions of the device. Thus in the previous example approximately 90% of the effectiveness of the magnetic pull of the device was available on the pole pieces 14, and approximately 80% was concentrated in a band about two inches wide, symmetrical with the center of the magnetic gap between the pole portions 17.

I claim:

In apparatus for removing tramp iron from wet material, a magnetic device including pole pieces having ends forming a substantially flat surface, a fluid conveying casing enclosing said surface, the faces of said pole pieces interrupting said flat surface to form a gap extending longitudinally of said casing, said casing having inlet and outlet pipes spaced above said surface at either end thereof, an adjustable gate pivotally mounted within said casing for free swinging movement and overlying said surface, said gate extending transversely with respect to the direction of flow of material to cause a flattened stream of fluid passing through said casing to flow across said surface, and a stop adjustably mounted in said casing for engagement with the outlet side of said gate.

CARL A. RIETZ.