E. W. DAVIS.

MAGNETIC ORE WASHER.

APPLICATION FILED MAR. 4, 1915.

1,153,037. Patented Sept. 7, 1915.

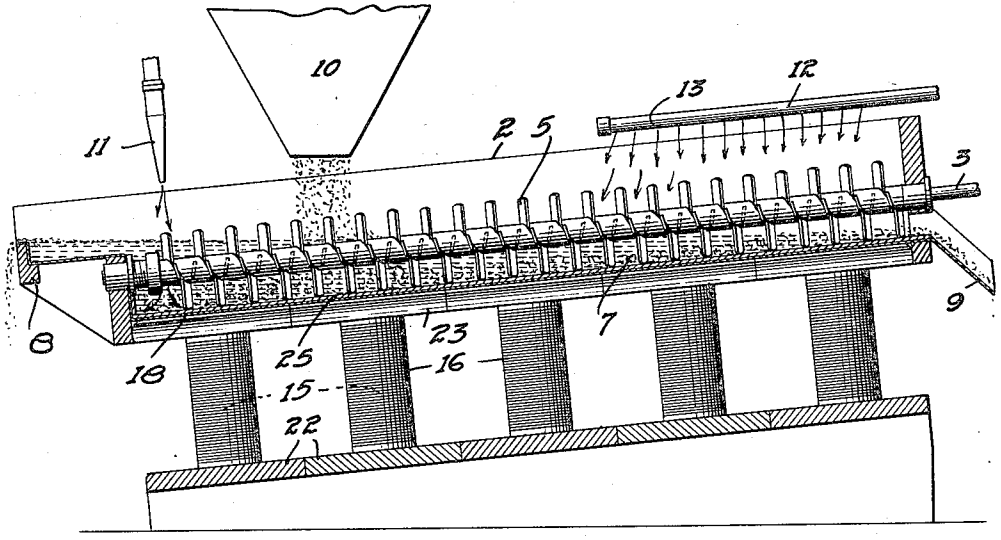


FIG. 1.

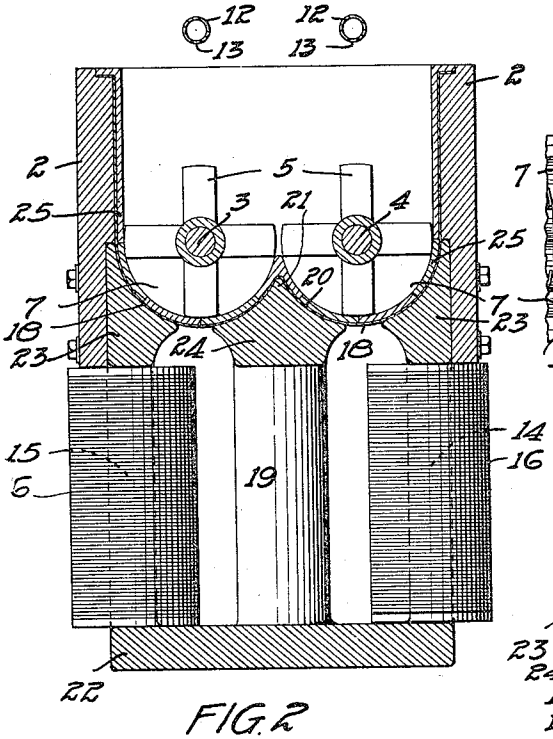


FIG. 2.

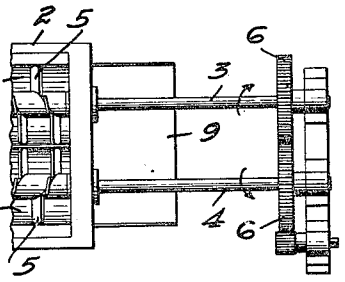


FIG. 3.

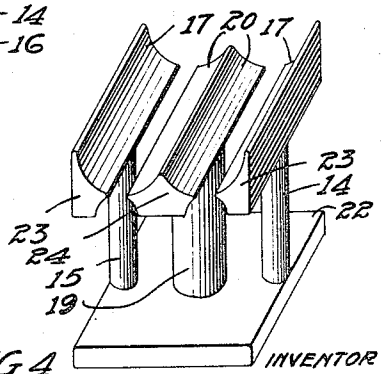


FIG. 4.

WITNESSES

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MAGNETIC ORE-WASHER.

1,153,037. Specification of Letters Patent. Patented Sept. 7, 1915.

Application filed March 4, 1915. Serial No. 12,130.

To all whom it may concern:

Be it known that I, EDWARD W. DAVIS, citizen of the United States, resident of Minneapolis, county of Hennepin, State of Minnesota, have invented certain new and useful Improvements in Magnetic Ore-Washers, of which the following is a specification.

The object of my invention is to provide an apparatus for separating iron ore from sand or gravel, generally known as "gangue," in which magnetic force or attraction is utilized to cause the adhering together and precipitation of lighter particles of ore which may be mingled with particles of sand or gravel of equal weight and which, in a gravity separator, would be carried out with the tailings of the machine.

A further object is to provide an ore separator of large capacity and one which is of simple construction and economical operation.

The invention consists generally in various constructions and combinations, all as hereinafter described and particularly pointed out in the claims.

In the accompanying drawings forming part of this specification, Figure 1 is a vertical sectional view through a magnetic ore separator embodying my invention, Fig. 2 is a transverse sectional view of the same, Fig. 3 is a detail view, showing the driving means for the log washer shafts, Fig. 4 is a perspective view of the field core.

In the drawing, 2 represents a log washer of ordinary construction, having shafts 3 and 4 provided with paddles or blades 5 driven through suitable gears 6 from a source of power, not shown. The shafts or blades of the log washer are made of non-magnetic material and there may be one or more of the troughs, as preferred. I have illustrated two of the troughs in this application, as I found that a convenient number to produce satisfactory results. The shafts turn in opposite directions in troughs 7 which are substantially semi-circular in cross section and are provided at one end of the log washer with a wall or weir 8 over which the waste water and non-magnetic material may escape, and at the opposite end with a spout 9. The log washer is arranged on an incline, as shown, so that the material will be fed upwardly by the revolving blades toward a spout 9, while the lighter waste material held in suspension will flow downwardly over the weir at the end of the washer. A suitable hopper 10 is provided above the washer in position to deliver the ore-bearing sand and gravel therein, and near the hopper at the lower end of the washer is a nozzle 11 for directing a stream of water into the lower part of the washer. Pipes 12 are arranged above the opposite end of the washer, parallel with the shafts 3 and 4, and have perforations 13 through which streams of water are directed into the troughs beneath. This log washer is of well known construction and further detailed description and illustration is unnecessary. The blades serve to agitate the material so that the lighter waste particles will float to the top, while the heavier particles of ore will naturally sink by gravity to the bottom and be fed upwardly by the blades to the discharge spout 9.

It will often happen in an apparatus of this kind that particles of ore of about the same weight as grains of sand or gravel will be stirred up by the revolving blades and will float toward the surface of the water and be carried out with the waste material. To avoid this loss, I propose to arrange a series of electro-magnets beneath the log washer, the lighter particles of ore which would naturally float in the moving stream of water with the sand and be carried out of the machine being directed by the magnets and precipitated to the bottom of the troughs and held by magnetic attraction as they are fed upwardly and out of the machine. These small particles as they enter the field of magnetic attraction will not only be drawn toward the pole pieces of the magnets, but will also adhere together, a number of particles uniting to form a larger particle and remaining in this relation while they are in the field of attraction of the magnets and also for a time after being discharged from the log washer.

In carrying out my invention, I prefer to provide magnets 14 and 15, having suitable windings 16 and curved upper surfaces 17 in which sheet copper plates 18 are seated. Between the cores 14 and 15 is a magnetic field piece 19 having surfaces 20 in which the copper plate 18 is seated, said field piece being between the troughs of the log washer and having an apex 21 which forms the dividing line between the bottoms of

the troughs. Cores 14 are in circuit with the field piece 19 through a base 22.

I prefer to arrange the magnets as indicated in Fig. 1, the cores being spaced apart a suitable distance and having heads 23 forming, with the cores, T-shaped field pieces on opposite sides of the correspondingly shaped field pieces 24. These T-shaped field pieces becoming energized, attract the particles of iron ore as they come within the field of magnetic attraction and draw them to the bottom of the troughs, where they will be fed upwardly by the revolving log washer blades.

To protect the copper plates from injury I provide wearing plates 25 of suitable non-magnetic material, placed over them in the bottom of the troughs and protecting these copper plates from the action of particles of sharp sand or gravel which, through the rubbing effect of the shaft blades, might puncture or wear the softer copper plates if exposed to direct contact with the log washing blades. The effect of these magnets in the bottom of the troughs of the log washer is to precipitate the small adhering particles of iron ore, which otherwise, being of about the same weight as the waste particles of sand, might float therewith and be carried out with the waste water. As soon, however, as these particles come within the magnetic field they will be directed and drawn to the bottom of the troughs and will be fed through these troughs to the discharge spout.

I have shown and described electro-magnets in connection with this invention, but it will be understood that pole pieces of this kind permanently magnetized may be used if desired.

I claim as my invention:

1. An ore separator comprising an inclined trough, curved in cross section, and means for feeding the material upwardly in said trough, and magnet field pieces extending continuously beneath said trough and conforming to the curvature thereof.

2. A magnetic ore separator comprising a trough arranged at an incline and having a curved bottom and a conveyer operating in said trough to feed the material upwardly therein, and magnets having pole pieces disposed beneath said trough, said pole pieces being substantially T-shaped and conforming to the curvature of the bottom of the trough.

3. A magnetic ore separator comprising a pair of inclined troughs arranged side by side in parallel relation, each having a curved bottom and conveyers operating in said troughs, electro-magnets mounted beneath said troughs and having outer pole pieces curved to conform to the outer side walls of said troughs, and intermediate pole pieces curved to conform to the inner portion of the bottoms of said troughs at the junction thereof with one another to form an apex between them.

4. An ore separator comprising a pair of inclined troughs arranged side by side in parallel relation, each trough having a curved bottom and conveyers operating therein, electro-magnets mounted beneath said troughs and having T-shaped pole pieces fitting the curved bottoms of said troughs, the heads of said pole pieces being placed end to end lengthwise of said troughs, one group of them extending along the middle line of the separator at the junction of the walls of said troughs and there being a group of said pole pieces beneath the outer portions of said troughs on each side of the middle group of pole pieces.

5. An ore separator comprising a pair of inclined troughs arranged side by side in parallel relation and means for feeding the material upwardly in said troughs, said troughs having a discharge spout for the material at their upper ends and a transverse wall at their lower ends, means for delivering a supply of water to said troughs, means for feeding the ore thereto, and magnets having pole pieces disposed beneath the inner adjoining walls of said troughs and also beneath the outer portions of said walls.

6. An ore separator comprising an inclined trough, a feeder operating therein, magnets having side pole pieces adjacent to the outer walls of the trough, and an intermediate pole piece adjacent the middle of the trough.

7. A magnetic ore separator comprising a pair of inclined troughs and a feeding means operating therein, magnets mounted beneath said troughs and having outer pole pieces conforming to the outer side walls of said troughs, an intermediate pole piece conforming to the inner portions of the bottoms of said troughs, said outer and intermediate pole pieces extending continuously along the bottom of said troughs.

8. A magnetic ore separator comprising troughs arranged at an incline, magnets having outer pole pieces adjacent the outer walls of said troughs, and intermediate pole pieces adjacent the inner walls of said troughs, a pipe for delivering water to the upper portion of said troughs, and a hopper for delivering ore-bearing material to the lower portion of said troughs.

In witness whereof, I have hereunto set my hand this 25th day of February 1915.

EDWARD W. DAVIS.

Witnesses:

EDWARD A. PAUL,

M. R. M'INNIS.