Q. BENT.

MAGNETIC ORE SEPARATING APPARATUS.

APPLICATION FILED NOV. 30, 1908.

954,016.

Patented Apr. 5, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

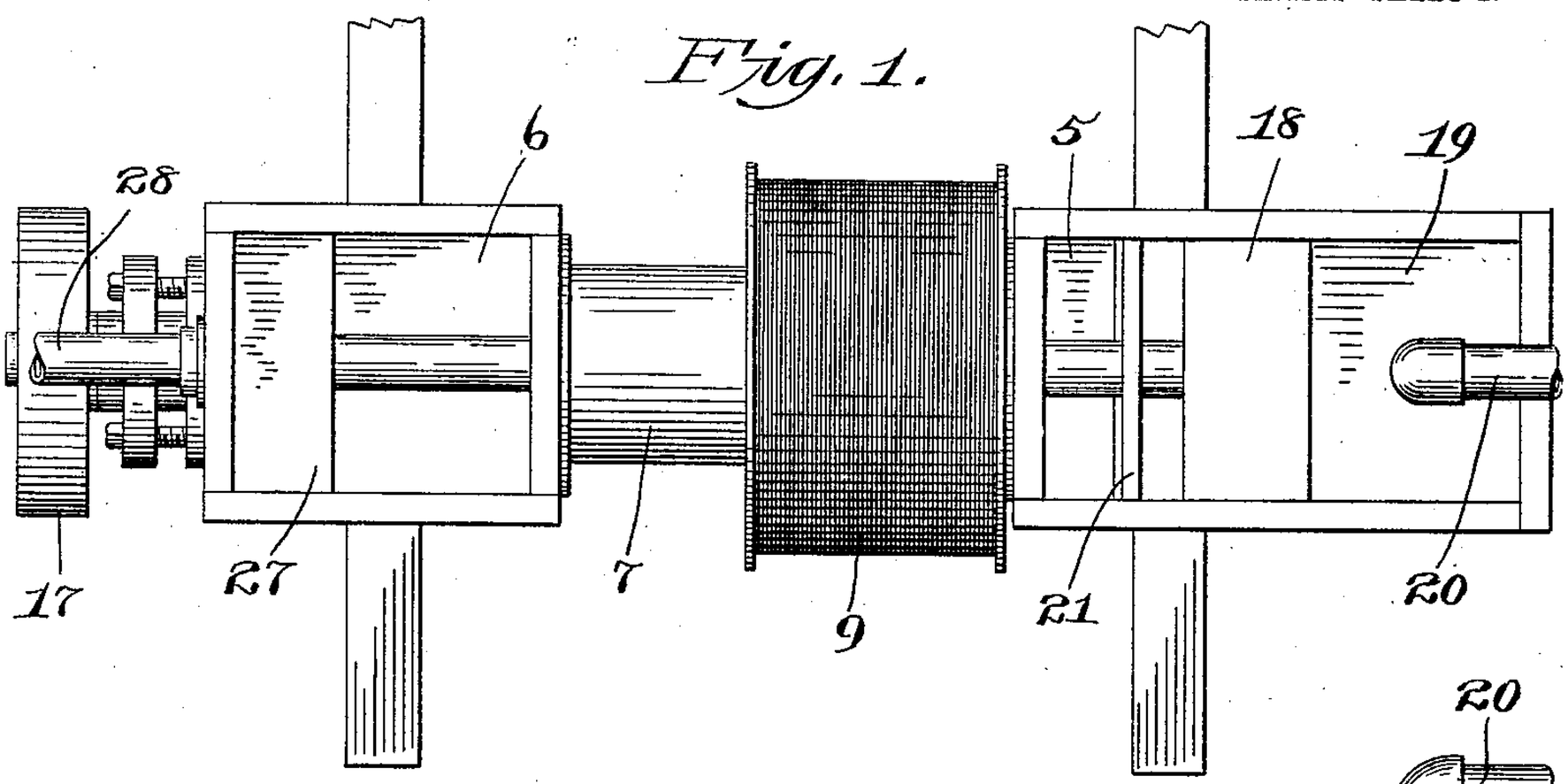
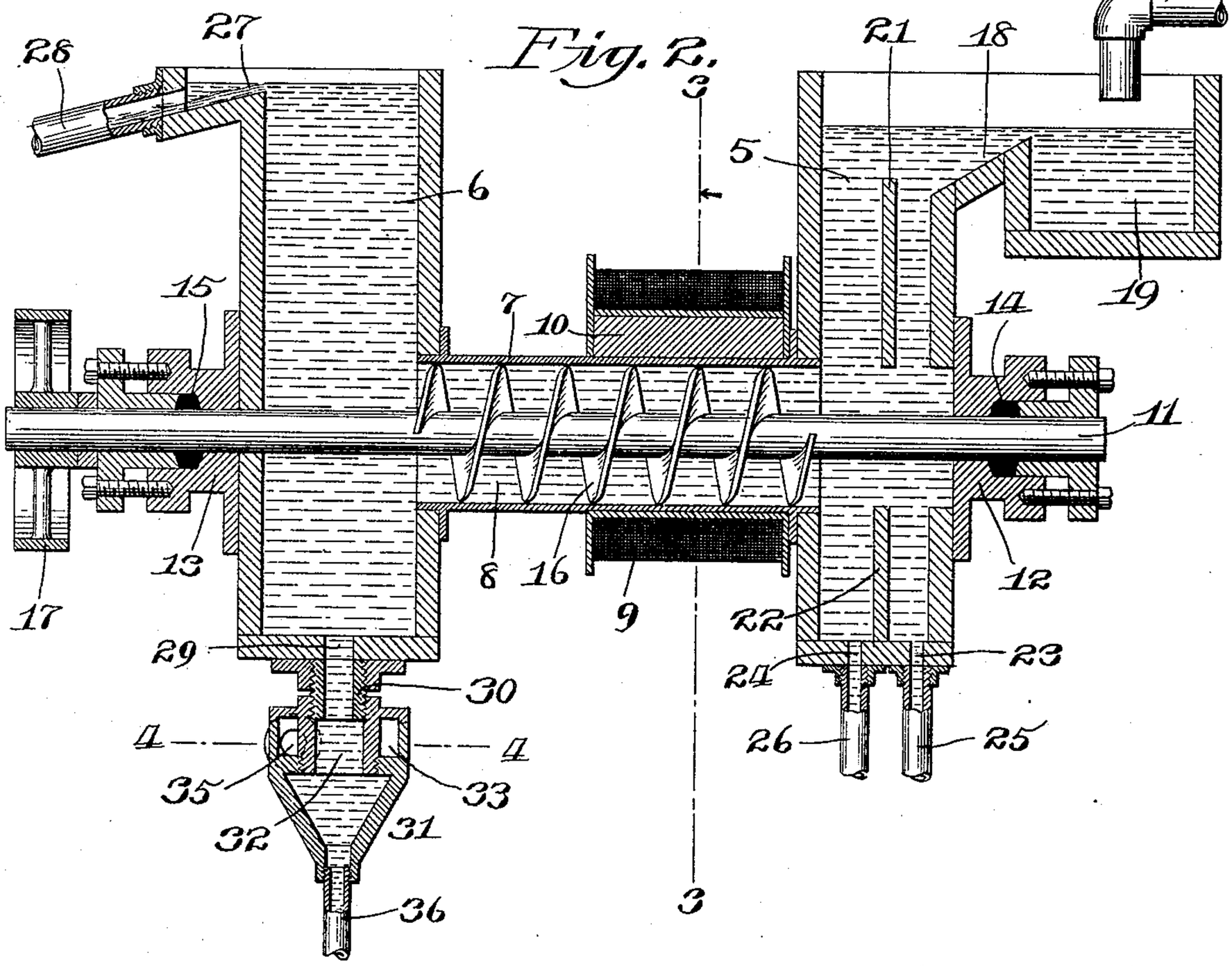


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

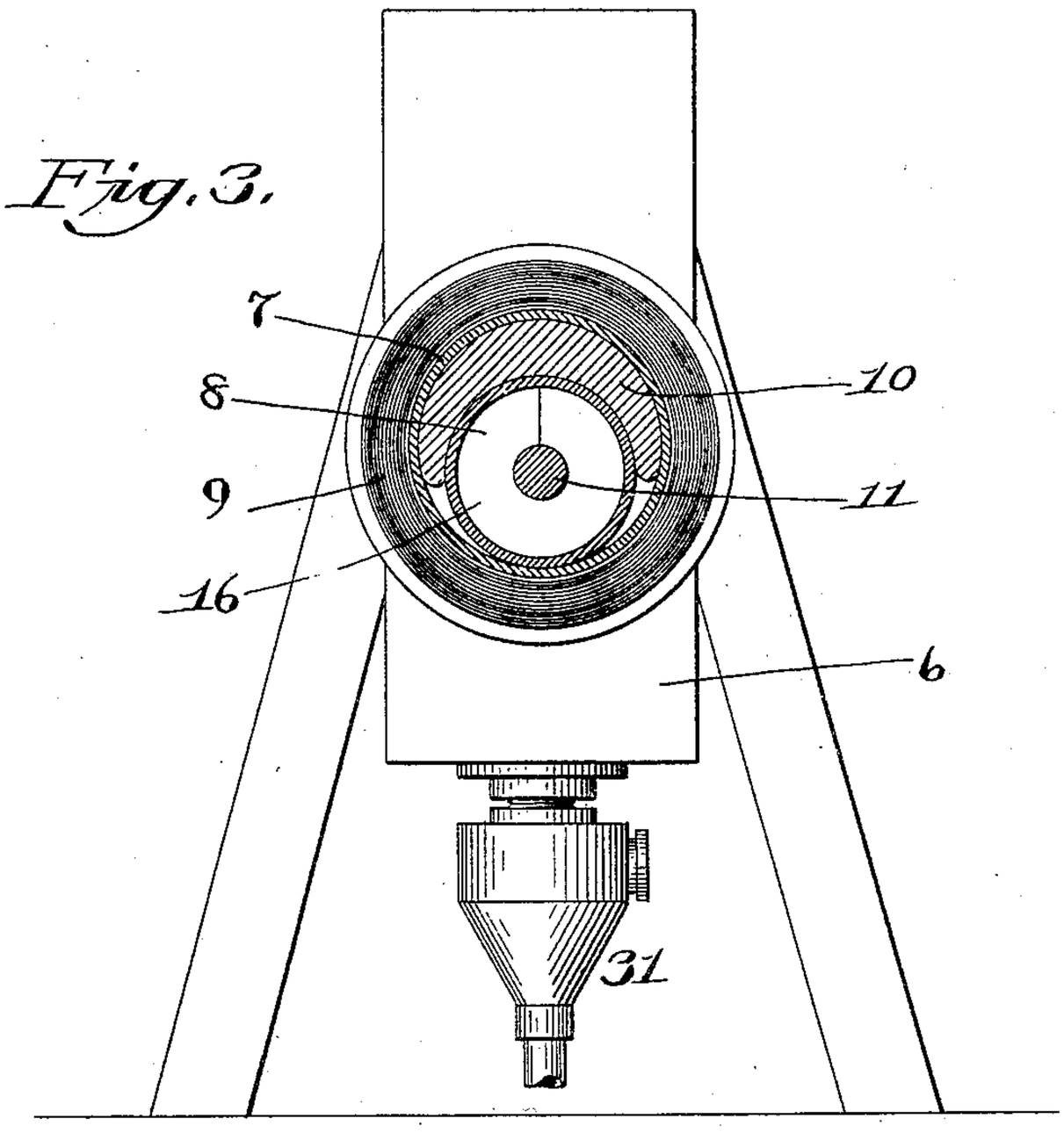
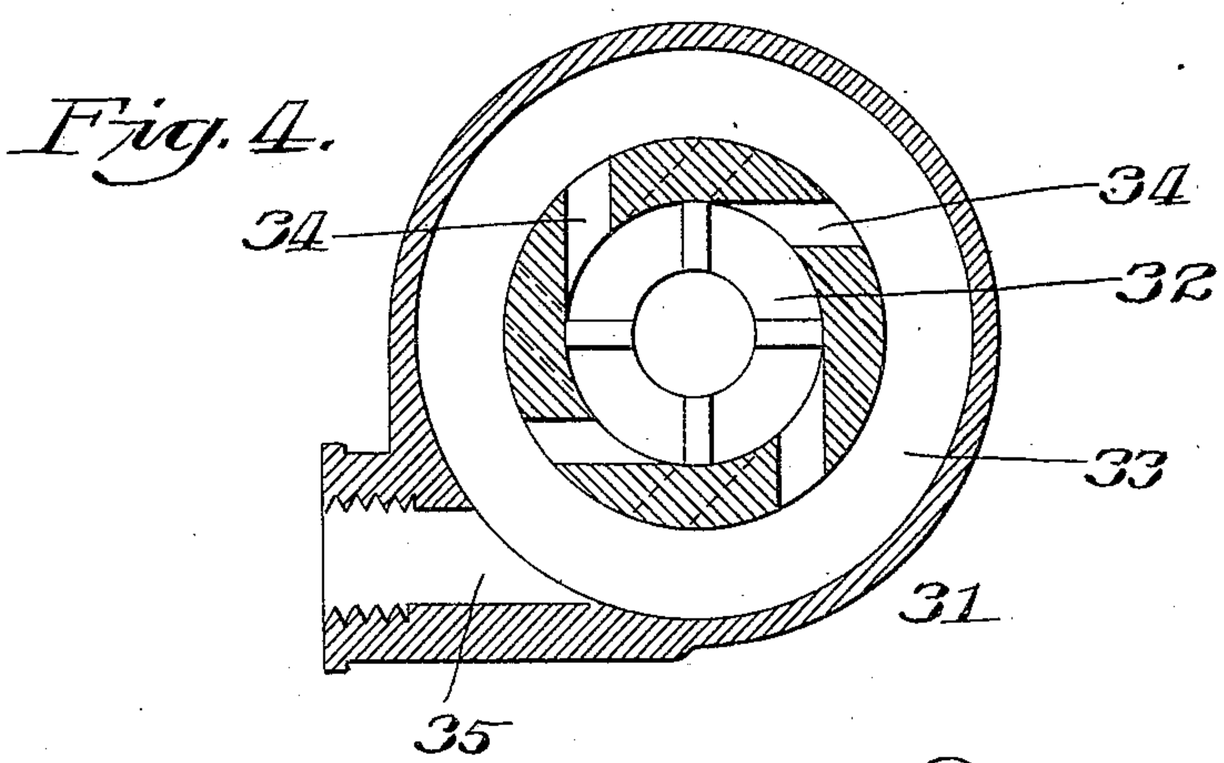


Fig. 4.



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UNITED STATES PATENT OFFICE.

QUINCY BENT, OF LEBANON, PENNSYLVANIA.

MAGNETIC ORE-SEPARATING APPARATUS.

954,016. Specification of Letters Patent. Patented Apr. 5, 1910.

Application filed November 30, 1908. Serial No. 465,071.

To all whom it may concern:

Be it known that I, QUINCY BENT, citizen of the United States, and resident of Lebanon, in the county of Lebanon and State of Pennsylvania, have invented certain new and useful Improvements in Magnetic Ore-Separating Apparatus, of which the following is a full, clear, and exact description.

The object of this invention is to provide a simple and efficient magnetic ore separating device.

The invention, as generally stated, consists in providing means for controlling the flow of water carrying the ore with relation to a magnet, whereby magnetic concentrates may be separated from the gangue or tailings; and further, in providing means for mechanically advancing the magnetic concentrates away from the magnet and subjecting the concentrates to a washing operation, all as will be hereinafter fully described and particularly claimed.

Reference may be had to my application for a patent for an improvement in magnetic separation of ore, filed November 30, 1908, Ser. No. 465,070.

In the drawings:—Figure 1 is a plan view of my improved magnetic ore separating apparatus. Fig. 2 is a longitudinal, vertical section thereof. Fig. 3 is a transverse, vertical section of the apparatus, as on the line 3—3 of Fig. 2. Fig. 4 is a horizontal section as on the line 4—4 of Fig. 2.

5 designates a vertically-arranged, water-receiving settling chamber, and 6 designates a vertically-arranged water-receiving washing chamber. The chambers 5 and 6 are located a slight distance apart, and they are connected by a cylinder 7 forming a water-passageway 8 which extends between and communicates with the chambers 5 and 6, the passageway 8 being located above the bottoms of said chambers.

Surrounding the cylinder 7 and passageway 8 therein is a solenoid 9, which is located adjacent the chamber 5. This solenoid 9 also surrounds a magnetic pole piece 10, which extends part way around and rests upon the cylinder 7. Electric current is supplied to the solenoid 9 in the usual manner, to produce the magnetic action thereof.

Extending centrally through the passageway 8 and also through the chambers 5 and 6, and beyond the walls thereof, is a shaft 11 which is mounted to rotate in suitable bearings 12 and 13 secured to the outer walls of the chambers 5 and 6 respectively. The bearings 12 and 13 are provided with suitable stuffing boxes 14 and 15 respectively, to prevent leakage of water from the chambers 5 and 6 through the openings through which the shaft 11 extends.

The shaft 11 is provided with a screw-conveyer 16 which is located within and extends the entire length of the passageway 8, the purpose of the screw 16 being to mechanically advance the magnetic concentrates through the passageway 8 in a direction away from the chamber 5 toward the chamber 6. One end of the shaft 11 is provided with a suitable pulley 17 by means of which the shaft and therewith the screw conveyer 16 may be rotated. The upper portion of the settling chamber 5 is provided with an inlet passageway 18 leading from a compartment 19 which receives the water carrying the ore from a feed pipe 20. The interior of the settling chamber 5 is provided with a baffle wall 21 which extends transversely of the chamber and is located between the inlet opening 18 thereof and the passageway 8. The lower portion of the chamber 5 is provided with a partition 22 extending transversely of the chamber 5 below the passageway 8, and dividing the lower portion of said chamber. The lower portion of the chamber 5 is provided with two outlet openings 23 and 24, one located on one side and the other on the other side of the partition 22, and leading from the openings 23 and 24 are pipes 25 and 26 which may extend to any suitable point of discharge.

The upper portion of the chamber 6 is provided with an overflow or outlet opening 27 which communicates with one end of a pipe 28, the other end of which may extend to any suitable point of discharge. The lower portion or bottom of the chamber 6 is provided with an inlet opening 29 which communicates with a downwardly extending short pipe 30 on the lower end of which is secured a vortex water-admission device 31, comprising a central opening or chamber 32 and a circular chamber 33 surrounding the central opening 32. The wall between the chamber 33 and the central opening 32 is provided with tangentially-arranged openings 34 through which water may pass from the chamber 33 to the central opening 32, and the chamber 33 is provided with a tangentially-arranged water-inlet opening 35

whereby when water is supplied to the device 31 through the opening 35, the water will be given a rotating motion during its passage through the chamber 33 and openings 34 into the central opening 32, wherein the water continues to rotate as it passes through the inlet opening 29 of the washing chamber 6. The lower portion of the central opening 32 communicates with an outlet pipe 36 for the water, which pipe may lead to any suitable point of discharge.

The operation of the apparatus is as follows:—The water carrying the crushed or pulverized ore is supplied to the compartment 19 through the feed pipe 20 from any suitable source, and another stream of water is supplied to the vortex admission device 31 through the inlet opening 35 therein; and power is supplied to the pulley 17 to rotate the shaft 11 and therewith the screw-conveyer 16, and electric current is supplied to the solenoid 9. The main body of the stream of water supplied to the device 31 flows upwardly through the washing chamber 6, and during its upward flow through said chamber the water continues the rotating motion given to it by the vortex device 31 until the water overflows at 27 and passes from the apparatus through the pipe 28 to a suitable point of discharge. Part of the stream of water supplied to the device 31, however, flows downwardly and out through the pipe 36. The stream of water carrying the ore and introduced to the compartment 19 through the feed pipe 20 flows from said compartment through the inlet opening 18 to the upper portion of the settling chamber 5, then downwardly through said chamber and out through the pipes 25 and 26 leading from the lower portion thereof. A part of the stream of water introduced through the feed pipe 20 may pass through the passageway 8 and a part of the stream of water introduced through the vortex device 31 may also pass through the passageway 8. This, however, is controlled by the relative forces of the two streams. It will be observed that the passageway 8 is located below the water level in each chamber 5 and 6. As the crushed or pulverized ore descends through the settling chamber 5 with or through the stream of water, the magnetic particles are drawn laterally from the chamber 5 and into the passageway 8 under the magnetic influence of the solenoid 9, while the tailings are permitted to descend to the bottom of the chamber 5 and are carried off to any suitable point of discharge through the pipes 25 and 26. As the stream of water carrying the ore enters the upper portion of the settling chamber 5, it strikes the baffle wall 21 which causes the heavy tailings to descend to the pipe 25 while the lighter, or middlings, descend to the pipe 26. The magnetic concentrates are drawn into the passageway 8 under the influence of the solenoid 9 and they are mechanically advanced through said passageway from the solenoid and discharged into the upwardly flowing stream of water and into the washing chamber 6 by the action of the screw-conveyer 16. The magnetic concentrates descend through this upwardly flowing stream of water while said stream carries upwardly and discharges from the overflow 27 and pipe 28 any small non-magnetic particles in suspension in the water that may pass through the passageway 8, thus effecting a final and complete washing of the magnetic concentrates which descend from the upwardly flowing stream of water through the lower portion of the central opening of the vortex device 31 and out through the pipe 36 which leads to any suitable point of discharge. The magnetic concentrates, as they pass through the passageway 8, are polarized under the influence of the solenoid 9, which causes the particles to assemble themselves in groups, thus causing them to descend through the upwardly flowing stream more rapidly than they would descend in their separated condition. This rapid descent of the magnetic concentrates enables me to cause the stream of water to flow upwardly through the chamber 6 very rapidly without carrying with it any of the magnetic concentrates, the rapid flow of the stream insuring a thorough washing of the concentrates. By rotating the stream of water during its upward flow through the washing chamber 6, it is caused to act upon the descending concentrates in a substantially uniform manner throughout the washing chamber. When desirable, I make the force of the stream flowing upwardly through the chamber 6 strong enough to cause a slight water current to flow through the passageway 8 toward the settling chamber 5, which tends to repel any non-magnetic material which might be carried from the chamber 5 into the passageway 8 mechanically with the concentrates.

I claim:—

1. In a magnetic ore separating apparatus, the combination of a liquid-receiving settling-chamber having a liquid opening therein, a wall forming a liquid passageway communicating with and leading laterally from said chamber, a magnet adjacent said passageway, and a conveying means projecting into said passageway and into the magnetic field and having a projection adapted to engage and positively convey the magnetically attracted material.

2. In a magnetic ore separating apparatus, the combination of a liquid-receiving settling-chamber having a liquid inlet-opening therein, a wall forming a liquid passageway communicating with and leading laterally from said chamber, a solenoid surround-

ing said passageway, and a conveying means projecting through the solenoid and having a projection adapted to engage and positively convey the magnetically attracted material.

3. In a magnetic ore separating apparatus, the combination of a liquid-receiving settling-chamber having a liquid inlet opening therein, a wall forming a liquid passageway communicating with and leading laterally from said chamber, a magnet adjacent said passageway, and a screw conveyer within said passageway.

4. In a magnetic ore-separating apparatus, the combination of a liquid-receiving settling-chamber having a liquid inlet opening in the upper portion thereof and a liquid outlet opening in the lower portion thereof, a wall forming a liquid passageway communicating with and leading laterally from said chamber, and a solenoid surrounding said passageway.

5. In a magnetic ore separating apparatus, the combination of a liquid-receiving settling-chamber having a liquid inlet opening therein, a liquid-receiving washing-chamber having a liquid inlet opening in the lower portion thereof and a liquid outlet opening in the upper portion thereof, a wall forming a passageway extending between said chambers and communicating therewith, a magnet adjacent said passageway, and means for mechanically advancing magnetic concentrates through said passageway.

6. In a magnetic ore separating apparatus, the combination of a liquid-receiving settling-chamber having a liquid inlet opening therein, a liquid-receiving washing-chamber having a liquid inlet opening in the lower portion thereof and a liquid outlet opening in the upper portion thereof, a wall forming a passageway extending between said chambers and communicating therewith, a solenoid surrounding said passageway, and means for mechanically advancing magnetic concentrates through said passageway.

7. In a magnetic ore separating apparatus, the combination of a liquid-receiving settling-chamber having a liquid inlet opening therein, a liquid-receiving washing-chamber having a liquid inlet opening in the lower portion thereof and a liquid outlet opening in the upper portion thereof, a wall forming a passageway extending between said chambers and communicating therewith, a magnet adjacent said passageway, and a screw-conveyer within said passageway.

8. In a magnetic ore separating apparatus, the combination of a liquid-receiving settling-chamber having a liquid inlet opening therein, a liquid-receiving washing-chamber having a liquid inlet opening in the lower portion thereof and a liquid outlet opening in the upper portion thereof, means for giving liquid a rotating motion while being introduced to the inlet opening of the washing chamber, a wall forming a passageway extending between said chamber and communicating therewith, a magnet adjacent said passageway, and means for mechanically advancing magnetic concentrates through said passageway.

9. In a magnetic ore separating apparatus, the combination of a liquid-receiving settling-chamber having a liquid inlet opening therein, a liquid-receiving washing chamber having a liquid outlet opening in the upper portion thereof, a wall forming a liquid inlet opening having communication with the lower portion of the washing chamber, a wall forming a liquid outlet opening having communication with the lower portion of the washing chamber, a wall forming a passageway extending between said chamber and communicating therewith, a magnet adjacent said passageway, and means for mechanically advancing magnetic concentrates through said passageway.

In testimony whereof, I have hereunto affixed my signature.

QUINCY BENT.

Witnesses:

GRANT WEIDMAN,

CLEMENT G. SMITH.