No. 877,439. PATENTED JAN. 21, 1908.

H. LEIGHTON.

APPARATUS FOR MAGNETICALLY CONCENTRATING ORES.

APPLICATION FILED SEPT. 19, 1906.

2 SHEETS—SHEET 1.

Fig. 1.

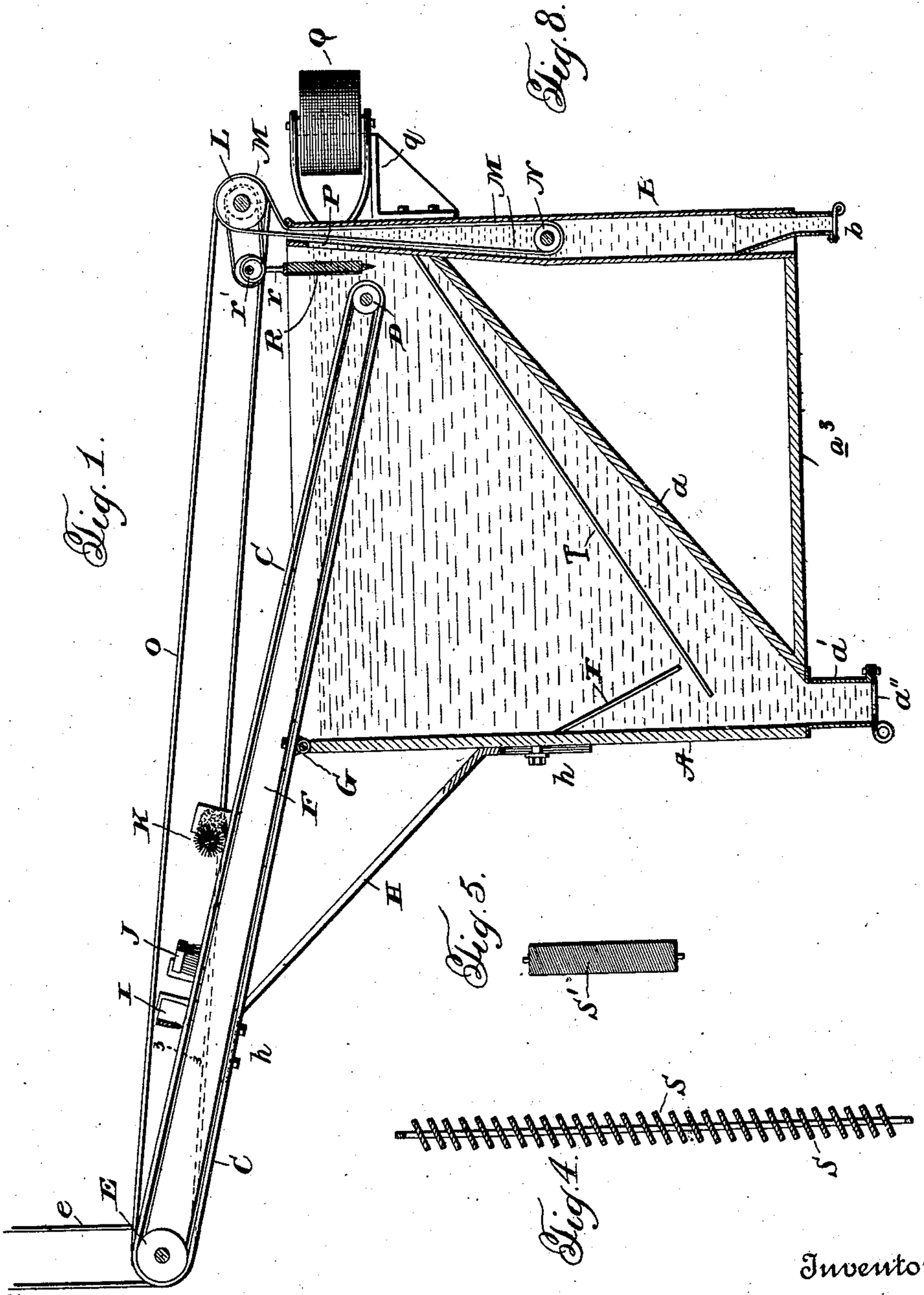

Fig. 2.

Fig. 3.

Fig. 4.

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2 SHEETS—SHEET 2.

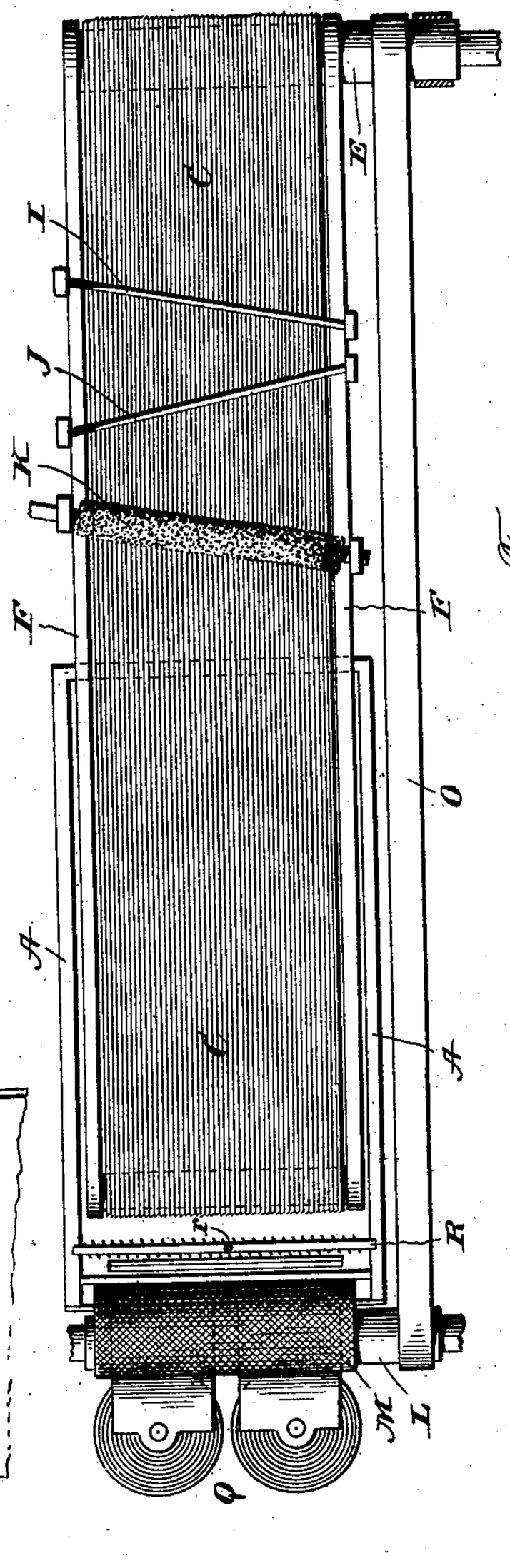

Fig. 2.

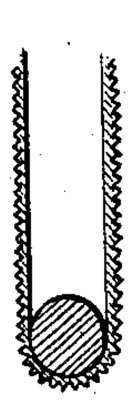

Fig. 6.

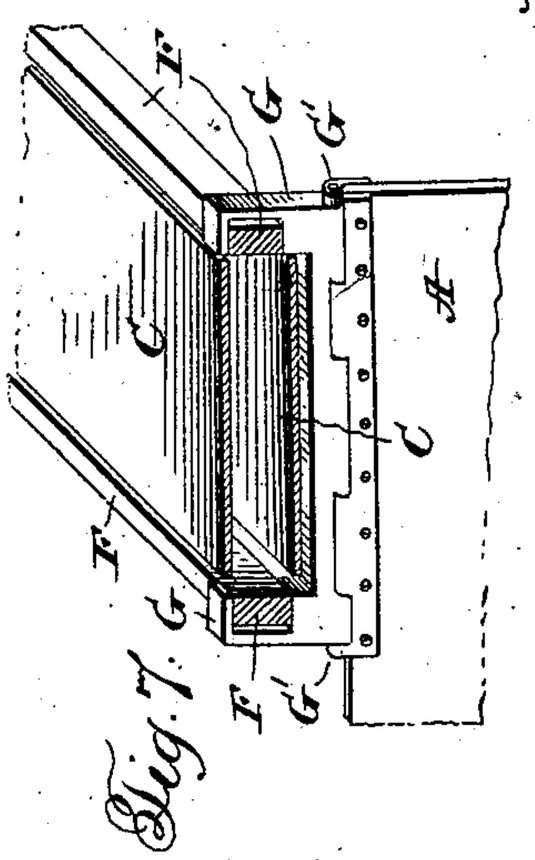

Fig. 1.

Fig. 3.

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APPARATUS FOR MAGNETICALLY CONCENTRATING ORES.

No. 877,439. Specification of Letters Patent. Patented Jan. 21, 1908.

Application filed September 19, 1906. Serial No. 335,323.

To all whom it may concern:

Be it known that I, HENRY LEIGHTON, a citizen of the United States, residing at Seattle, in the county of King and State of Washington, have invented certain new and useful Improvements in Apparatus for Magnetically Concentrating Ores, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to the magnetic separation of substances having magnetic permeability, from ores and mixtures with which they are associated, by passing said ores or mixtures in a comminuted or granular state through a magnetic field.

The invention is particularly designed for the treatment of materials in the wet state, the object being to effect the separation of material in this condition in an inexpensive and more effective manner than has heretofore been possible.

One of the essential features of the invention is to provide intermediate the conveyer or feed for the comminuted material and the energized magnet, a preliminary separator, the same being arranged to agitate the water and act on the material as it leaves the discharge end of the conveyer and flows towards the magnet.

More particularly, the invention has reference to the agitation and separation of mats or strips of material, forming entanglements in the water of magnetic and non-magnetic particles which by the force of the magnet flow towards the same. This constitutes an important feature of the invention, since the result accomplished is one which heretofore unaccomplished made the magnetic separation of the ores in a wet state commercially impracticable and incomplete. According to my invention, it will be seen that the ore or other mixture as it passes from the conveyer to the magnetic field is acted upon by a mechanical separator, which may, as hereinafter particularly described, conveniently be an agitating screen, slatted frame, or any desired mechanical contrivance tending to positively agitate the water intermediate the magnet and the conveyer and separate the magnetic and the nonmagnetic material which have become entangled, with the result that the nonmagnetic particles contained in the mixture will be thoroughly separated and freed and allowed to fall.

The invention further consists of a novel and efficient conveyer or feed, whereby may be regulated to a nicety, the amount of material fed to the point of separation.

The invention also includes improved adjusting instrumentalities for the said conveyer or feed.

Other novel features will be pointed out in the detailed description following, and will be readily understood when read in connection with the accompanying drawings forming a part hereof, and wherein a preferable embodiment of the invention is disclosed for the purpose of illustration.

In the drawings: Figure 1 is a longitudinal sectional view of the apparatus complete. Fig. 2 is a top plan view, with parts cut away. Fig. 3 is a cross section of the conveyer or feed on the line 3—3 of Fig. 1. Fig. 4 is a detail view in section of the primary separator detached. Fig. 5 is a detail plan view of one of the slats of the separator detached. Fig. 6 is a sectional view illustrating a modified form of conveyer or feed. Fig. 7 is a detail view partly in section illustrating the pivotal and slidable connection between the conveyer and receptacle, and Fig. 8 is a detail view of a modified form of agitator.

Referring now more particularly to the drawings, wherein like reference characters designate corresponding parts throughout the several views, A is a receptacle or trough adapted to contain water and being of any convenient construction, open at its top and having an inclined bottom a leading to an outlet passage a' having a suitable closure a''. Secured to one wall of said receptable, preferably at the rear, is an auxiliary receptacle B, one wall of which being the adjacent wall of the receptacle A and preferably extending downwardly to a point in line with the outlet end of the receptacle A and supported at its lower end by the false bottom a^3 of the receptacle B. A suitable closure b is provided for the outlet end of the receptacle B.

C is a conveyer or feed adapted to receive from a hopper or the like, not shown, the comminuted or granular material to be separated, the same leading to a point within the tank whereby the material will be submerged adjacent the discharge end of the conveyer. The said conveyer preferably comprises an endless belt construction mounted at its respective ends on pulleys D and E, the latter receiving power through the medium of a belt e from any suitable source. The conveyer C is supported intermediate its ends by

a suitable frame-work F which latter has a pivotal connection with the top of the front end of the receptacle A through the medium of a bracket G pivoted to the receptacle at G′ and constituting guides for said frame. It is thus seen that the conveyer C has a longitudinal as well as a pivotal adjustment relative to said receptacle through the medium of the bracket G. In order to support the forward end of the conveyer which extends beyond the receptacle, and retain the same in its adjusted positions, a bracket H is provided having angle extensions *h* and *h′* which latter have a suitable pin and slot connection with the front wall of the receptacle A and the framework F of the conveyer, respectively.

The conveyer or feed surface proper comprises a corrugated, grooved or indented surface, the corrugations extending either longitudinally of the conveyer, as shown in Figs. 1 and 4, at an angle or transversely of the conveyer, as illustrated in the modified form of conveyer in Fig. 6. Arranged to coöperate with said corrugated or indented surface of the conveyer is a suitable scraper I, an adjustable brush or brushes J and a rotatable brush or brushes K, each of which being arranged at an angle one to the other, transversely of the conveyer or feed, and tending to regulate to a fine degree the amount of material fed into the receptacle. By reason of the fact that the conveyer surface is corrugated, this regularity of feed is made possible and cannot be accomplished by the continuous or smooth surfaced feed or conveyer of the ordinary construction. While I have illustrated and described this conveyer or feed in the form of an endless carrier or belt, I do not desire to be limited to this construction, as obviously any other conveying means may be employed, the essential object being that the surface itself be corrugated or indented for the reception of the material. Mounted in any suitable manner above the receptacle B is a carrier roll L upon which is mounted a nonmagnetic feed belt M which latter extends within the receptacle and is supported at its lower end by the roll N mounted in any desired manner.

O is a belt adapted to impart movement to the roll N, the former being operatively associated at its opposite end with the roll E.

The rear wall of the receptacle A has an opening P and the outer wall of the receptacle B has secured thereto, in any desired manner, as by a bracket *q*, an electro-magnet Q, the latter being arranged in registration with said opening P. Projecting into the receptacle A at a point adjacent the opening P and in front of the lower end of the conveyer C is an agitator or separator R, reciprocating in any desired direction, but preferably having at its upper end a stem *r* and an eccentric engagement *r′* with any suitable power member, whereby the separator will receive a vertical reciprocation. This separator receptacle or agitator comprises a series of separated inclined slats or panels S extending in a vertical or transverse direction or at an angle, the same being illustrated as extending vertically and one or both of the upper surfaces of the slats or panels are roughened as clearly shown at S′ in Fig. 5. From this portion of the description it will be seen that as the material leaves the discharge end of the conveyer or feed C and comes within the magnetic field, the water separating the wall of the receptacle and said end of the conveyer will become agitated by the reciprocation of the separator R and the mats or strips of any magnetic or nonmagnetic material which have become entangled and tend to flow toward the magnet will be effectively separated in their passage over the roughened surface of the slats as drawn thereover by the magnetic force on the opposite sides thereof. It is thus seen that the entangled magnetic and nonmagnetic material having been separated, the nonmagnetic material will fall by gravity towards the bottom of the tank while the magnetic material passes through the passage or opening P into contact with the nonmagnetic belt, by which it is conveyed beyond the magnetic field and drops to the bottom of the receptacle B. While I have shown a slatted arrangement as a convenient form of agitator, I desire it to be expressly understood that my invention is not limited to this particular form, for obviously any mechanical contrivance whatsoever which would tend to agitate the water or disentangle the magnetic and nonmagnetic material which have become entangled after leaving the discharge end of the conveyer and prior to their passage to the conveying belt M, is within the intent and spirit of my invention. For instance, a screen such as illustrated in Fig. 8 may conveniently be employed, and wherein in the claims I use the term "agitator" I desire it to be understood that included by this term is any means whatsoever for accomplishing the above result.

The operation may be briefly described as follows: The conveyer or feed is adjusted through the means described, until the discharge end thereof assumes the desired position with respect to the agitator and magnet, the comminuted or granular material discharged thereonto through any suitable source, the material filling the corrugated or indented surface thereof, and the amount of said material being regulated by the scraper I and further acted upon and leveled by the brushes J and K. The agitator R is then operated through the medium of the cam or other connection to reciprocate through the water, which latter will thereby become agitated in the magnetic field at a point between

the magnet and the discharge end of the feed, and any entanglement of the nonmagnetic with the magnetic material flowing towards the magnet under the influence of the latter will be thoroughly disentangled by contact with the surface or surfaces of the agitator, with the aid of the agitated water. The magnetic particles which have now become thoroughly separated continue their course toward the magnet and after passing through the opening P of the receptacle A are fed, through the medium of the belt M to the bottom of the receptacle B, while the nonmagnetic materials fall to the bottom of the receptacle A.

After the gold and other materials have been thoroughly separated from the magnetic materials, as above described, the said materials in the receptacle A may be subjected to an amalgamating process and to this end, I have shown, in dotted lines in Fig. 1, oppositely disposed inclined plates T having amalgam surfaces and separated at their adjacent lower ends to form an outlet for the material separated from the gold in its passage over said plates. This operation is obvious to one skilled in the art and need not be further explained.

While I have shown the conveying means for the separated magnetic particles in the form of an endless belt, it is obvious that any other movable surface separating the magnetic from the nonmagnetic material may be employed.

Having thus described my invention, I claim:

1. In a magnetic separator for treating materials in a wet state, a receptacle adapted to contain water, a magnet, means for feeding the material into the water into the magnetic field, and means interposed between the end of the feeder and the magnet in the direct path of the material for agitating the water between the discharge end of the feed and the magnet.

2. In a magnetic separator for treating materials in a wet state, the combination of a magnet, a water receptacle, means for feeding the material into the water towards the magnet, and means interposed between the end of said feeding means and the magnet in the direct path of the material for acting upon the material intermediate the discharge end of the feed and the magnet at an angle for disentangling the magnetic and nonmagnetic materials which may have become entangled, and by force of the magnet flow towards the same.

3. In a magnetic separator for treating materials in a wet state, the combination of a magnet, a water receptacle, means for feeding the material into the water towards the magnet, and an agitator within the water interposed between the end of said feeding means and the magnet in the direct path of the material adapted to act upon the materials as they flow by the force of the magnet towards the same.

4. In a magnetic separator for treating material in a wet state, the combination of a magnet, a water receptacle, means for feeding the material into the water towards the magnet, and a reciprocating separator interposed between the discharge end of the feed and the magnet, and in the direct path of the material.

5. In a magnetic separator for treating materials in a wet state, the combination of a magnet, a water receptacle, means for feeding the material into the water toward the magnet, and means interposed between the discharge end of the feed and the magnet and in the direct path of the material whereby the magnetic and nonmagnetic materials which may have been entangled are disentangled, the said means including a series of separated inclined surfaces over which the material may pass.

6. In a magnetic separator, the combination of a magnet, means for feeding the material to be acted upon towards the magnet, and a separating means interposed between the discharge end of the feed and the magnet and in the direct path of the material, the same including a series of separated inclined surfaces.

7. In a magnetic separator, the combination of a receptacle adapted to contain water, a magnet, means for feeding the material to be acted upon into said receptacle towards the magnet, and a separating means interposed between the discharge end of the feed and the magnet and in the path of the material, the same including an inclined member having a roughened surface over which the material plays under the force of the magnetic influence.

8. In a magnetic separator, the combination of a magnet, means for feeding the material to be acted upon towards the magnet, and a movable separating means interposed between the discharge end of the feed and the magnet, the same including a series of inclined roughened surfaces, separated from one another by an unobstructed space.

9. In a magnetic separator, a magnet, and means for feeding the material to be acted upon towards the magnet, comprising an elongated conveyer or feed, a movable separator interposed between the discharge end of the feed and magnet and in the direct path of the material, a support for the feed, and a pivotal connection between the conveyer and support, whereby the discharge of the feed relative to the separator and magnet may be varied.

10. In an apparatus of the character described, a receptacle, means for delivering the material into the upper portion of said receptacle, a magnet at one side of the re-

ceptacle, and an agitator interposed between the end of the feed means and the magnet across the direct path of the material from the feeder to the magnet.

11. In an apparatus of the character described, and in combination, a magnet, feed means horizontally spaced from said magnet and adapted to feed material into the space between the magnet and the feed means and an agitator vertically disposed in the space between the magnet and the end of the feed, and extending across the direct path of the material from the feeder to the magnet.

12. In combination, a receptacle adapted to hold water a magnet at one side of the receptacle, feed means pivotally and slidably supported on the other side of the receptacle extending toward the magnet in an inclined direction and adapted to deliver the material into the space in front of the magnet.

13. In combination, a receptacle adapted to hold water, a magnet at one side of the receptacle, feed means pivotally and slidably supported on the other side of the tank, extending towards the magnet in an inclined direction and adapted to deliver the material into the space in front of the magnet, and a vertically disposed agitator in the space between the feeder and the magnet.

14. In a magnetic separator for treating materials in a wet state, the combination of a magnet, a water receptacle, means for feeding the material into the water towards the magnet, and means interposed between the feed and the magnet and in the direct path of the material for separating the magnetic and nonmagnetic particles in the magnetic field.

In testimony whereof I affix my signature in presence of two witnesses.

HENRY LEIGHTON.

Witnesses:

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CARRIE A. KREY.