

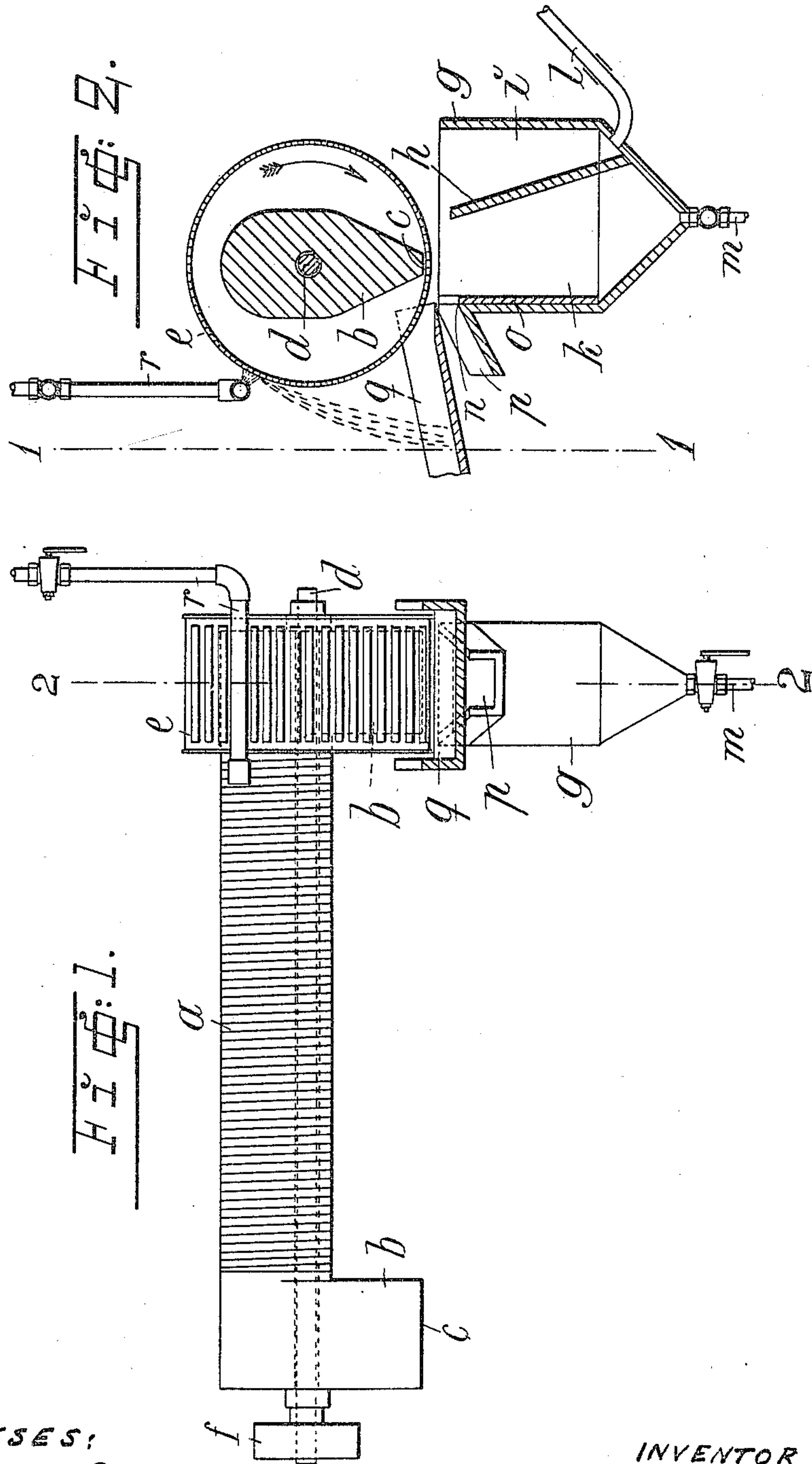
No. 812,170.

PATENTED FEB. 6, 1906.

G. GRÖNDAL.

APPARATUS FOR MAGNETIC SEPARATION OF IRON ORE.

APPLICATION FILED NOV. 12, 1903.



WITNESSES:
F. W. Wright
E. W. Collins

INVENTOR
Gustaf Gröndal
BY
Howden and Howden
HIS ATTORNEYS.

UNITED STATES PATENT OFFICE.

GUSTAF GRÖNDAL, OF DJURSHOLM, SWEDEN.

APPARATUS FOR MAGNETIC SEPARATION OF IRON ORE.

No. 812,170.

Specification of Letters Patent.

Patented Feb. 6, 1906.

Application filed November 12, 1903. Serial No. 180,904.

To all whom it may concern:

Be it known that I, GUSTAF GRÖNDAL, a subject of the King of Sweden and Norway, and a resident of Djursholm, Sweden, have
5 invented certain new and useful Improvements in Apparatus for Magnetic Separation of Iron Ore, (for which I have applied for a patent in Norway, dated April 7, 1903, No. 16,254,) of which the following is a specification.
10 tion.

This invention relates to improved apparatus for effecting, by means of a magnetic separation of pulverized iron ore, a practically-complete separation of the most magnetic
15 particles—the particles of pure iron ore—from the less magnetic particles and the gangue and at the same time to separate the latter two from each other. For this purpose the material pulverized to the necessary small
20 size is suspended in water (which may be termed "ore-pulp") and led horizontally, or nearly so, through a magnetic field in the proximity of but not in contact with the pole-piece of a stationary magnet. By modifying,
25 on the one hand, the force of the magnet and, on the other hand, adjusting the distance between the pole-piece and the surface of the current with the suspended material and varying the depth and rapidity of said current
30 the magnetic particles are attracted and separated from the non-magnetic particles at some distance on the side of the pole-piece, and the most magnetic particles—those of pure magnetic iron ore, for instance—in passing
35 the pole-piece are lifted up out of the water toward the magnet, while the less magnetic particles are not drawn through and out of the water, but remain in a layer at and under the surface of the water, the said layer
40 being richer than the layer underneath. The particles drawn out of the water are gathered separately, and the richer layer of the current containing the less magnetic particles is led off separately to be further enriched, if desired.
45 In order to gather and lead away the particles drawn toward the magnet, each of the pole-pieces of the magnet is surrounded by a hollow drum made of a magnetically-indifferent material, such as zinc or brass, the
50 said drum being kept rotating in the same direction as the current containing the suspended material. The pole-piece is formed with an edge lying behind and near the part of the drum past which the current is led, the
55 mantle of the drum being provided with lamellæ of iron inserted into it, which carry

the particles along with them a bit and then let them loose. Water jets directed against the drum on suitable places may, however, be used for removing them wholly. 60

In the accompanying drawings there is shown diagrammatically and as an example only a form of apparatus for carrying out the separation.

Figure 1 is an elevation, partly in section, 65 along the line 1 1 of Fig. 2. Fig. 2 is a vertical section along the line 2 2 of Fig. 1.

a is an electromagnet. *b b* are its pole-pieces, which are formed with a downwardly-directed elongated edge *c*. 70

d is a shaft passing through the magnet and carrying the drums *e* around the pole-pieces, respectively, and a belt-pulley *f* for rotating the drums. In the drawings the drum, with the accessory parts, is omitted at one of the 75 pole-pieces.

g is a vessel divided into two compartments *i* and *k* by an inclined partition *h*. 80

l is a supply-pipe for the suspended material entering into the compartment *i*, and *m* 80 is a discharge-pipe provided with a cock from the compartment *k*.

n is an overflow-discharge, located a little lower than the top of the partition *h*.

o indicates an adjustable plate for varying 85 the height of the overflow-discharge. *p* is a channel leading therefrom.

q is a channel located above the overflow-discharge.

r is a water-pipe provided with perfora- 90 tions toward the drum *e* for washing away the ore particles.

The apparatus operates as follows: The vessel *g* is filled with water and the drum *e* is put in rotation. The suspended material is then 95 let on through the pipe *l*, and it rises in the chamber *i* and over the top of the partition *h*. From this edge the current containing the suspended material flows toward the overflow-discharge *n*, and on the way the separation is effected by means of the powerful mag- 100 net in such a manner that the magnetic material is drawn upward toward the surface of the current already from the beginning and the non-magnetic material is left to sink. 105 When right under the edge *c* of the magnet, the most magnetic particles are lifted out of the water toward the drum *e* and they fasten on the latter, while the less magnetic particles flow away over the overflow-discharge *n* 110 through the channel *p* and are gathered for further treatment. The non-metallic mate-

rial, or the gangue, which falls down in the compartment *k* is drawn off through the pipe *m*. The particles adhering to the rotating drum *e* fall off and are washed from the drum and fall down into the channel *g*, being gathered for further treatment.

The apparatus may be arranged either so that each pole-piece treats a separate current of suspended material or so that one of the pole-pieces treats a portion already separated by the other pole-piece, the said portion being thus subjected to a second separation.

My improved method of magnetically separating iron ore herein described forms the subject of a divisional application for patent, filed by me December 3, 1904, Serial No. 235,394.

I claim as my invention—

1. Apparatus for magnetically separating ores, consisting of a magnet, a moving surface under the magnet-pole, a compartment having an overflow to maintain a body of liquid with a surface-level in proximity to but not in contact with said moving surface under the magnet-pole, an inlet for the ore whereby it may float suspended in the said liquid, and an outlet for the non-magnetic material from the lower part of the compartment, and a channel to carry off the magnetic material which has been drawn out of the water.

2. Apparatus for magnetically separating ores, consisting of a magnet, a moving surface under the magnet-pole, a compartment having an overflow to maintain a body of liquid with a surface-level in proximity to but not in contact with said moving surface under the magnet-pole and at the same time to carry off the less magnetic particles drawn to the surface of but not out of the water, an inlet for the ore whereby it may float suspended in the said liquid, an outlet for the non-magnetic material from the lower part of the compartment and a channel to carry off the magnetic material drawn out of the water.

3. Apparatus for magnetically separating ores, consisting of a magnet, a moving surface under the magnet-pole, two compartments, the first adapted to receive the ore suspended in water and to overflow the same into the second compartment, the two adapted to maintain the body of liquid with a surface-level in proximity to, but out of contact

with, said moving surface under the magnet-pole, an outlet for the non-magnetic material from the lower part of the second compartment, and a channel to carry off the magnetic material which has been drawn out of the water.

4. Apparatus for magnetically separating ores, consisting of a magnet, a revolving lamellated drum having the magnet-pole within it, a compartment having an overflow to maintain a body of liquid with a surface-level in proximity to, but not in contact with, the drum-surface under the magnet-pole, an inlet for the ore whereby it may float suspended in the said liquid and an outlet for the non-magnetic material from the lower part of the compartment and a channel to carry off the magnetic material which has been drawn out of the water.

5. An apparatus for magnetically separating iron ores, comprising a stationary electromagnet, having a pole-piece formed with an elongated edge, a rotating hollow drum of a magnetically indifferent material provided with iron lamellæ in its mantle surrounding the pole-piece, and means for passing the current containing the suspended material to be separated past, beneath and out of contact with the drum in such a manner that the direction of motion is at right angles against the edge of the pole-piece of the magnet, and the same as the direction of motion of the drum whose mantle moves between the edge of the pole-piece and the current of water, said means consisting of a vessel located under the drum, a partition dividing it into two compartments lying side by side, the one compartment being provided at the bottom with a supply-pipe for the suspended material, and the other compartment being provided at the bottom with a discharge-conduit for the non-magnetic part of the material, and at the top with an overflow-discharge for the less magnetic part of the material.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GUSTAF GRÖNDAL.

Witnesses:

G. FINBERG,
MANFRED SÄNSTRÖM.