No. 812,172. PATENTED FEB. 6, 1906.

G. GRÖNDAL.

MAGNETIC SEPARATION OF IRON ORE.

APPLICATION FILED DEC. 3, 1904.

Fig. 2.

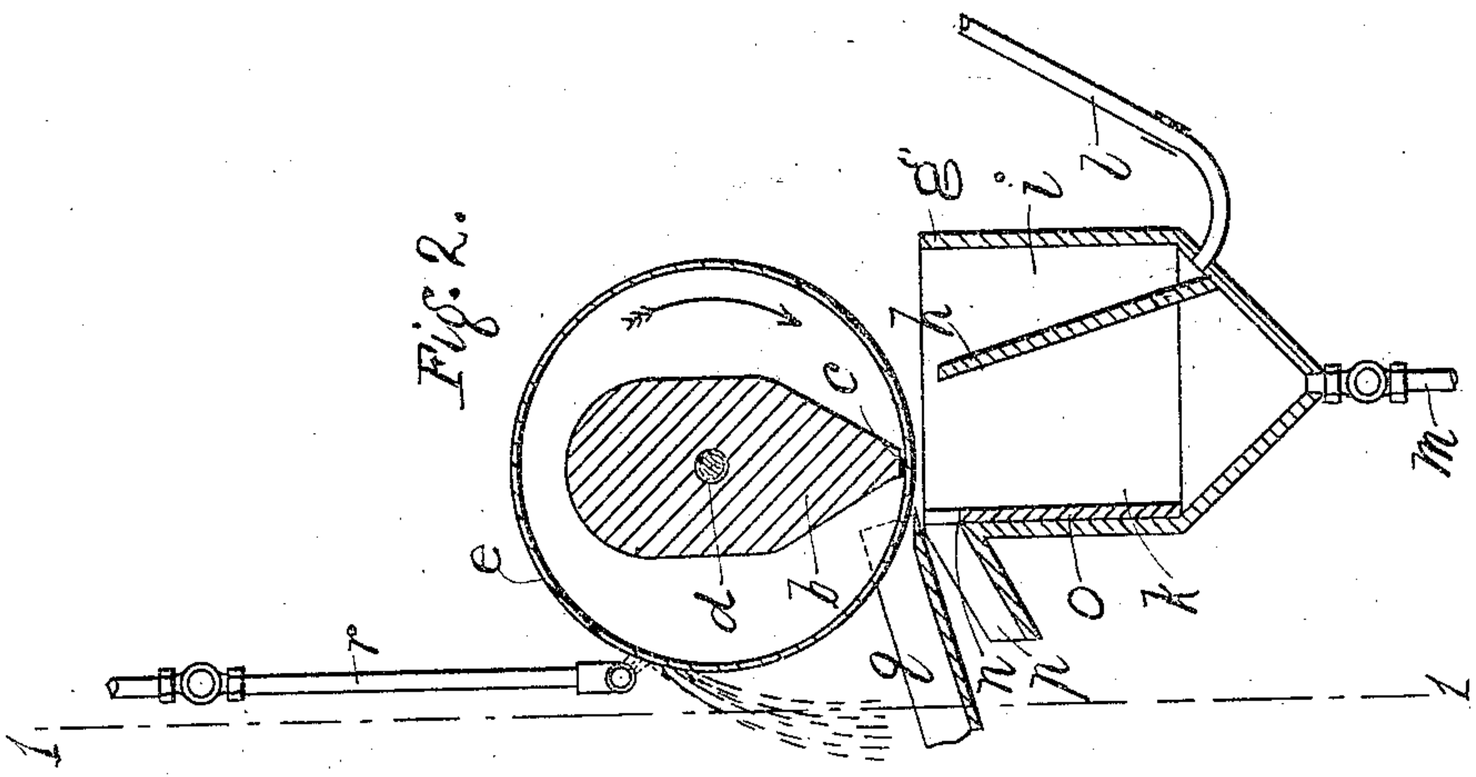
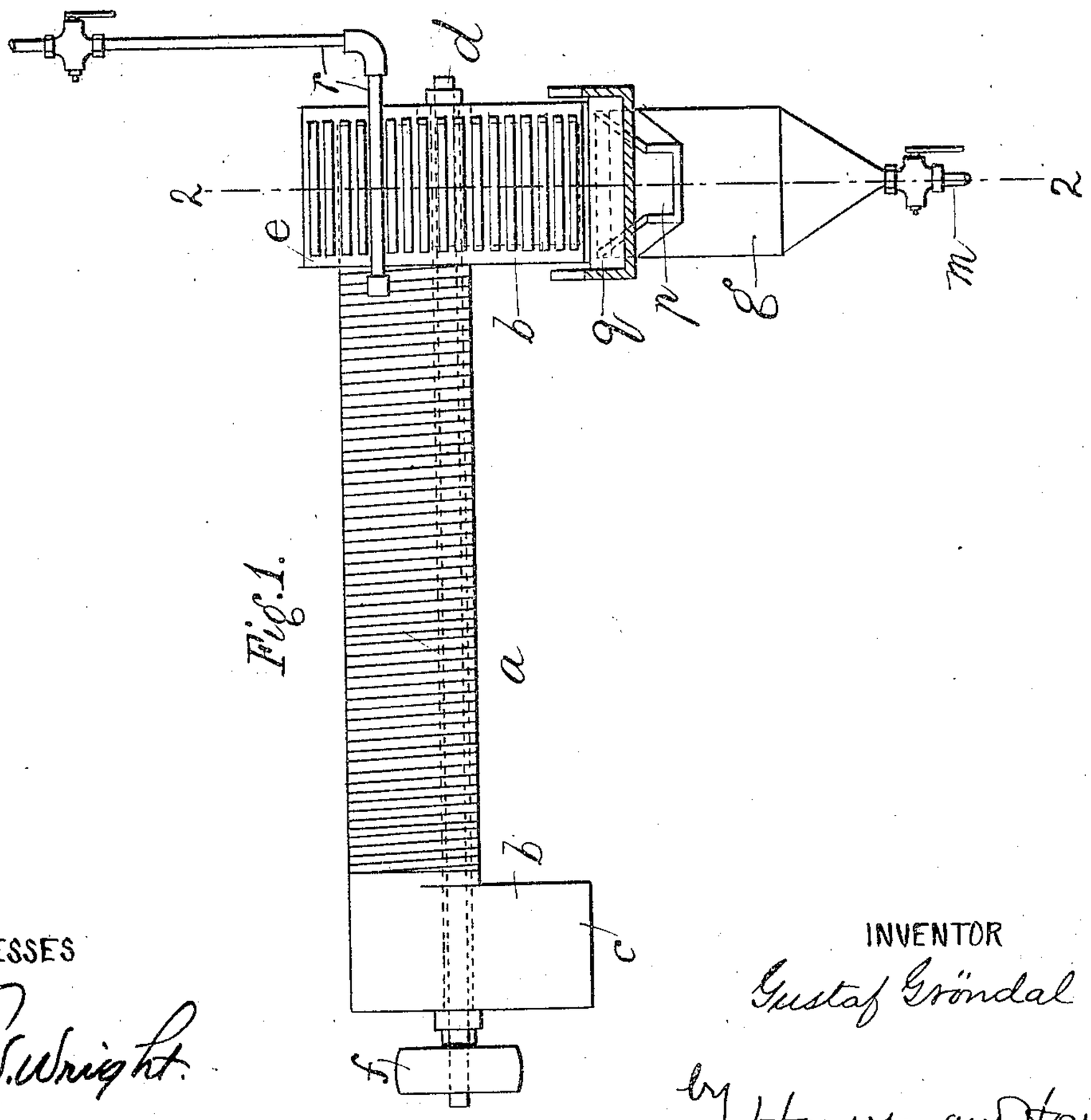


Fig. 1.



WITNESSES

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GUSTAF GRÖNDAL, OF DJURSHOLM, SWEDEN

MAGNETIC SEPARATION OF IRON ORE.

No. 812,172. Specification of Letters Patent. Patented Feb. 6, 1906.

Original application filed November 12, 1903, Serial No. 180,904. Divided and this application filed December 3, 1904. Serial No. 235,394.

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 invented certain new and useful Improvements in Magnetic Separation of Iron Ore, (for which I have applied for a patent in Norway, April 7, 1903, No. 16,254,) of which the following is a specification.

The present invention refers to a method of effecting by means of a magnetic separation of pulverized iron ore a practically complete separation of the most magnetic 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 size is suspended in water 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 properly designing the apparatus as to the power of the magnet the distance between the pole-piece and the surface of the current with the suspended material and by regulating the depth and rapidity of said current 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 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 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.

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 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 mantle of the drum being provided with lamels 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.

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, along the line 1 1 in the Fig. 2. Fig. 2 is a vertical section along the line 2 2 of the Fig. 1

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

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 pole-pieces.

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

l is a supply-pipe for the suspended material entering into the compartment *i*, and *m* 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 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 perforations 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 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 magnet 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, 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-dis-

charge *n* through the channel *p* and are gathered for further treatment. The non-metallic material, or the gangue which falls down in the compartment *k*, is drawn off through the pipe *m*. The particles adhering to the slowly-rotating drum *e* fall off and are washed from the drum and fall down into the channel *q*, 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.

I claim as my invention—

1. The process of separating pulverized ore, consisting in suspending said ore in a body of liquid, maintaining the surface-level of this liquid substantially horizontal under a moving surface in proximity to but free from contact with the surface of the liquid, magnetically lifting the more magnetic particles out of the water to said moving surface, removing the particles from the latter at another point, and withdrawing the non-magnetic material at the bottom of the body of liquid.

2. The process of separating pulverized ore, consisting in suspending said ore in a body of liquid, maintaining the horizontal surface-level of this liquid under a moving surface in proximity to but free from contact with the surface of the liquid by maintaining a surface overflow, magnetically lifting the more magnetic particles out of the liquid into a layer on the said moving surface, gathering the layer of particles which have been lifted out of the water, and withdrawing the non-magnetic material at the bottom of the body of the liquid.

3. The process of separating pulverized ore, consisting in leading a stream of liquid carrying the ore horizontally below in proximity to but free from contact with a moving surface, magnetically pulling the most magnetic particles of ore up out of the liquid into a layer on said moving surface and at the same time gathering less magnetic particles of ore in the liquid near its surface and leading the same away and letting the dead ore sink down in the liquid and flow away.

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

GUSTAF GRÖNDAL.

Witnesses:
GUSTAF JEM,
M. G. AUSTROM.