S. R. SALWÉN.

MAGNETIC ORE SEPARATOR.

APPLICATION FILED OCT. 9, 1914.

1,141,883. Patented June 1, 1915.

3 SHEETS—SHEET 1.

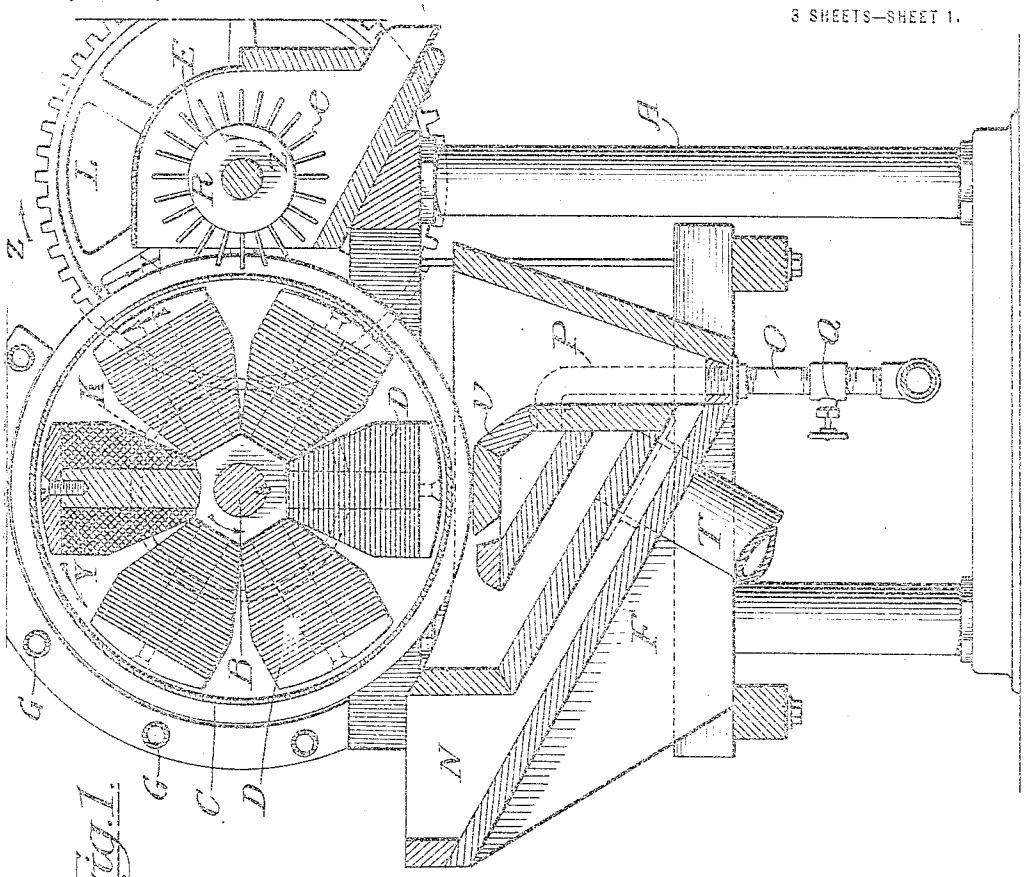


Fig. 1.

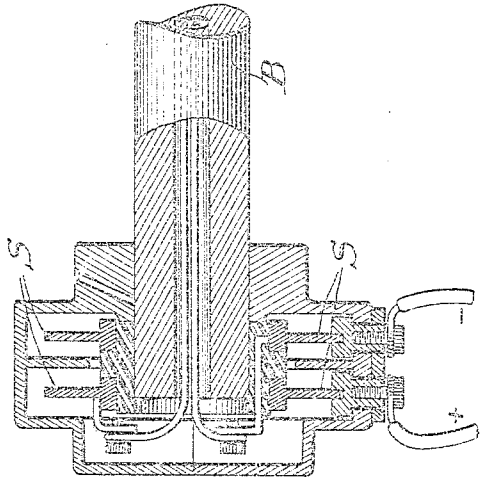


Fig. 2.

WITNESSES

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L. B. Grote

INVENTOR

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BY

Howson and Howson

His ATTORNEYS

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3 SHEETS—SHEET 2.

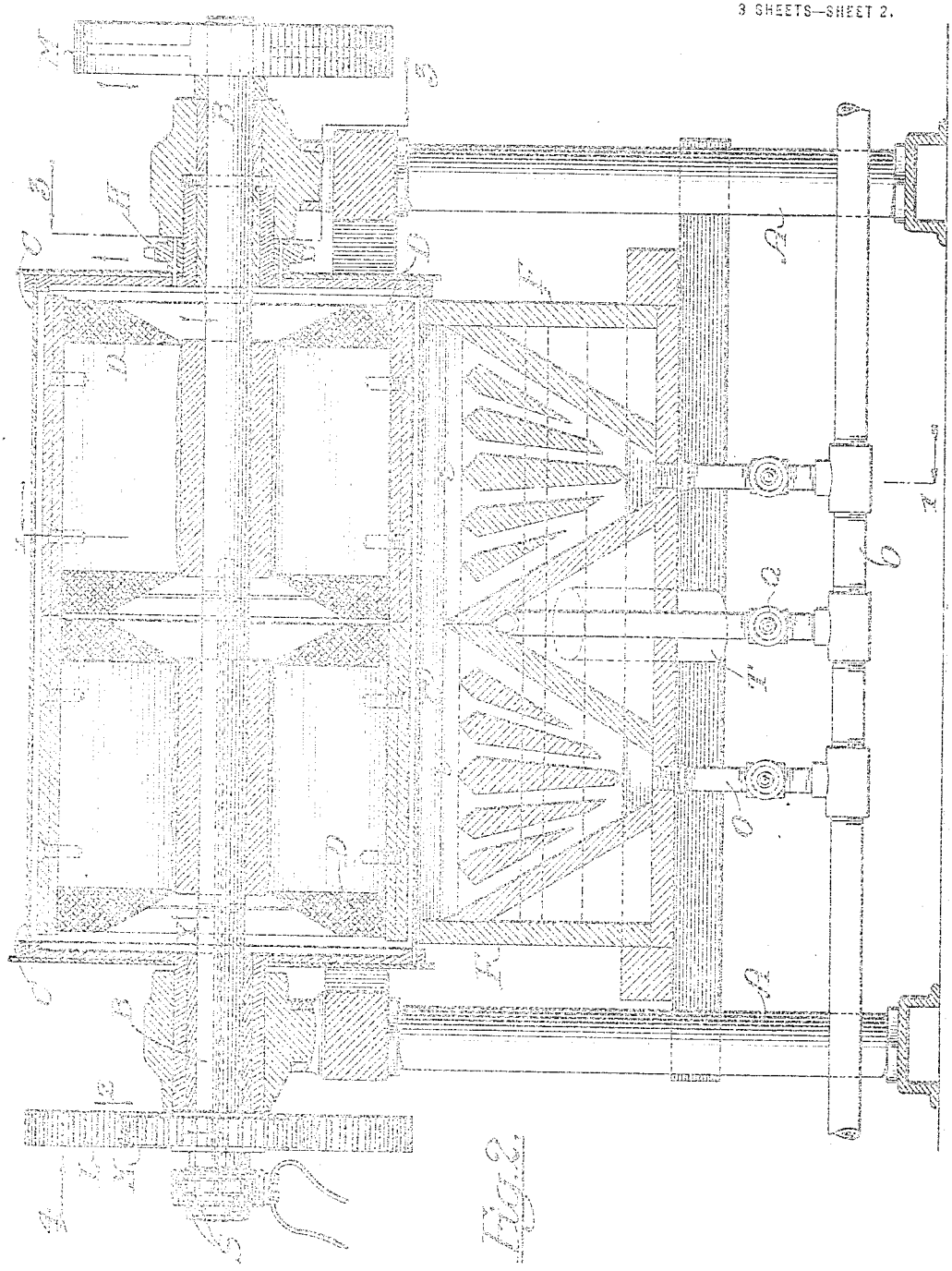


Fig. 2.

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3 SHEETS—SHEET 3.

Fig. 4.

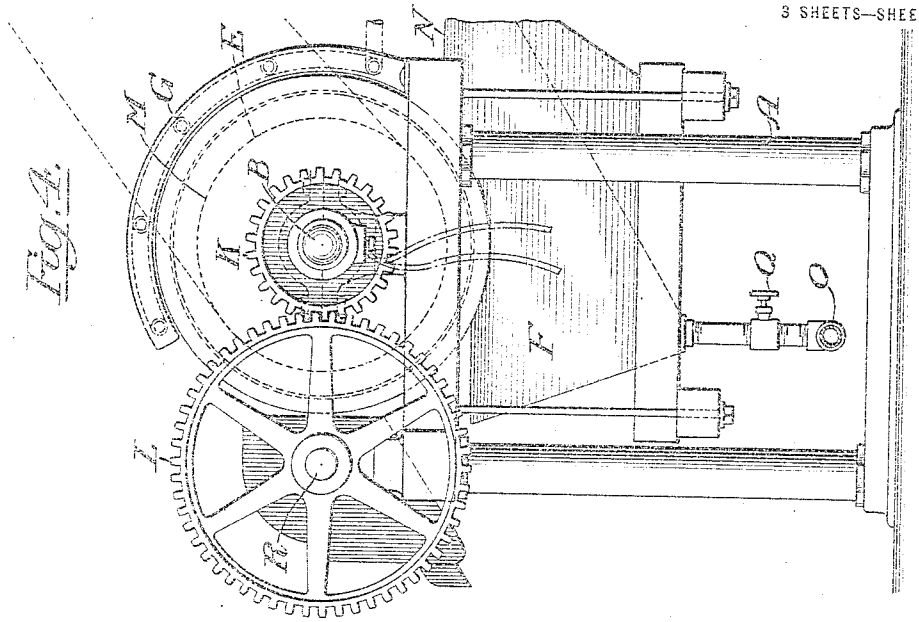
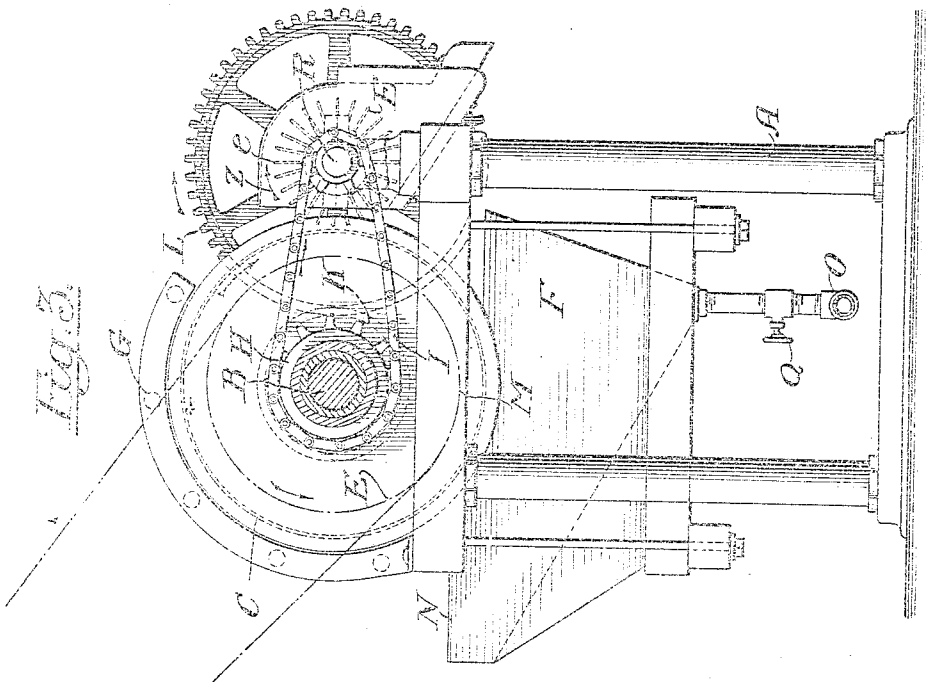


Fig. 3.



WITNESSES

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INVENTOR

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UNITED STATES PATENT OFFICE.

SVEN RAGNAR SALVÉN, OF GRÄNGESBERG, SWEDEN, ASSIGNOR TO AMERICAN ORENDAL COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

MAGNETIC ORE-SEPARATOR.

1,141,926. Specification of Letters Patent. Patented June 1, 1915.

Application filed October 8, 1914. Serial No. 865,964.

To all whom it may concern:

Be it known that I, SVEN RAGNAR SALVÉN, a subject of the King of Sweden, residing at Grängesberg, Sweden, have invented certain new and useful Improvements in Magnetic Ore-Separators, of which the following is a specification.

My invention relates more particularly to improvements in the apparatus for the magnetic separation of pulverized ores, forming the subject of the Grondal Patent No. 812,170, dated February 6th, 1906, and the object of my invention is to construct the apparatus so as to obtain cleaner concentrate and a larger capacity than other separators of the same size, without increasing the losses in the tailings.

The invention comprises the combination of a cylindrical drum of iron or other magnetic material, and a plurality of magnets of alternating polarity, arranged inside the drum symmetrically around an axle with the poles in close proximity to the drum, and means for rotating the magnets with relation to the drum and preferably in opposite directions to the latter, a feed box placed underneath the drum for the crude ore, water pipes arranged for spraying and washing of the ore on the drum, and means for removing the concentrated ore from the drum to a receptacle.

In the accompanying drawings, Figure 1 is a vertical cross section of a separator embodying my invention in one form; Fig. 2 is a longitudinal section of the same; Figs. 3 and 4 are elevations of an arrangement for rotating the drum and the magnets in opposite directions; and Fig. 5 is a cross section of a detail.

The stationary frame A supports a horizontal, revolving shaft B to which the magnets C are attached, and around which the drum D which is of magnetic material may be rotated in the direction of the arrow Z. The magnets revolve in the opposite direction as indicated by arrow Y. Two trough-like vessels V are supported under the drum and divided by partitions into compartments which in this case are arranged so that the ore can be fed to the separator at M.

O are pipes for supplying water at the bottom of the vessels and P is a pipe for supplying it at other points where it might be found desirable. The flow of water is regulated by valves Q.

E is an off-taker which may be in the form of a revolving drum, from which a number of iron bars *e* or iron sheets project as indicated in the drawing. The shaft R driving this off-taker in the direction of the arrow Z can be used as counter-shaft for driving the magnets and the drum in opposite direction to each other, one drive being made by gears K and L and another by chain and sprocket H and I. The driving pulley M is in this case attached to the shaft B but it can also be attached to the shaft R or to another counter-shaft connected to either one of these two shafts. The current for the magnets can be conveyed through ordinary slip rings S. The separator can be built with one, two or several sets of magnets, each set containing an even number of magnets of alternating polarity, and arranged symmetrically around the axle as the spokes in a wheel. The drawing shows a separator with two sets, in which case the vessel under the drum can be given a W form, as indicated in Fig. 2.

The tailings from the separator are discharged through a pipe T. The concentrate while adhering to the drum is washed by water from perforated spray pipes G. The crude ore, which should be finely pulverized, is fed with a stream of water to the feed box at N and slides down the inclined bottom to the lowest point where it meets a stream of water coming through the pipe O. It is carried upward suspended in water, and finds its way over the bridge U where it gets within the range of a strong magnetic field which pulls the magnetic particles out of the water, and makes them adhere to the drum while the non-magnetic particles follow the water and are discharged through the pipe T. Because the magnets and the drum revolve in opposite directions there will be a periodical change of polarity at every point of the drum. As this is made of iron, the polarity in the drum itself, owing to the hysteresis, will not change synchronously with the field of the magnets, but will lag behind so that when a pole approaches a certain point on the drum this point will still have some residual magnetism induced by the preced-

ing pole that had passed. The ore particles which have been attracted to the drum will cling together in little strings, each string acting as a magnet with a north and a south pole.

In order to make clear the action of the separator, I shall assume that the current is on the magnets, but that they as well as the drum are standing still. The little strings of ore will all be arranged in lines across the face of the drum, conforming to the flux of the magnets. On certain lines parallel to the axle of the drum, the strings will be standing right out from the face, in others they will lie flat on the drum, and in between these two extremes they will be arranged at gradually changing angles. Assume now that the magnets inside the drum are being rotated, but that the drum itself is kept in the same position. The combined fields of the magnets and the residual magnetism in the drum cause the strings of ore to turn end for end, and to move along the periphery of the drum in opposite direction to the movement of the magnets. If the drum now also is revolved in the opposite direction to the magnets, the movement of the ore along the periphery will be accelerated. As the ore particles will move faster than the drum, they will be distributed in thinner layers than would be the case if they moved at the same speed as the drum or at a lower speed. This will explain why this separator has a larger capacity than other types in which the ore moves no faster than the drum, and in many cases keeps slipping on its face so that it actually gets bunched together and moves much slower than the drum. From this description it is evident that the separator will work even if the drum is standing still, and that the ore then will travel over the drum in opposite direction to the motion of the magnets. While the ore is kept tumbling in thin strings over the face of the drum the non-magnetic particles which often get inclosed in the bunches of ore that are pulled out of the water by the magnets, will be released and will drop into the tailings. To help the cleaning of the ore a number of water sprays from perforated pipes G are directed toward the face of the drum, and continually wash the ore and relieve it of any non-magnetic slimes and other impurities that may adhere to the ore grains. This washing goes on while the ore is carried from the box underneath the drum until it is delivered at the off-taker E, where the ore particles jump across to the iron pegs owing to induced magnetism therein and are delivered to a launder as a finished product or to be retreated in another machine.

The vessel under the separator need not be of the particular construction shown, but preferably conforms to its general type. Similarly the drum construction may be varied so long as it maintains its essential characteristic as a magnetic drum, since the apparatus will not separate properly with a non-magnetic drum.

I claim as my invention:—

1. In a magnetic separator, a plurality of magnets of alternating polarity mounted on a suitable axis, a rotary magnetic drum arranged around said magnets and in close proximity to their poles, and means for rotating the magnets and drum simultaneously in opposite directions.

2. In a magnetic separator, a plurality of magnets of alternating polarity mounted on a suitable axis, a rotary magnetic drum arranged around said magnets and in close proximity to their poles, and means for rotating the magnets and drum simultaneously in opposite directions, in combination with means for washing the ore while it is tumbling over the face of the drum.

3. In a magnetic separator, a plurality of magnets of alternating polarity mounted on a suitable axis, a rotary magnetic drum arranged around said magnets and in close proximity to their poles, and means for rotating the magnets and drum simultaneously in opposite directions, in combination with a magnetic off-taker arranged at least 180° distant in the direction of the rotation of the drum from the point at which the ore is fed to the drum, together with means for constantly washing the ore while it is tumbling over the face of the drum to the off-taker.

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

SVEN RAGNAR SALWÉN.

Witnesses:
C. BRODÉN,
IRETA PRIEN.