No. 731,446. PATENTED JUNE 23, 1903.

A. E. FORSGREN.

MAGNETIC SEPARATOR.

APPLICATION FILED JAN. 13, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

Fig. 3.

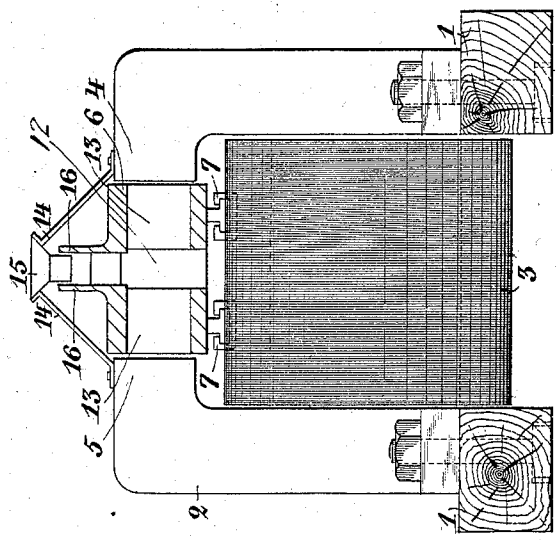
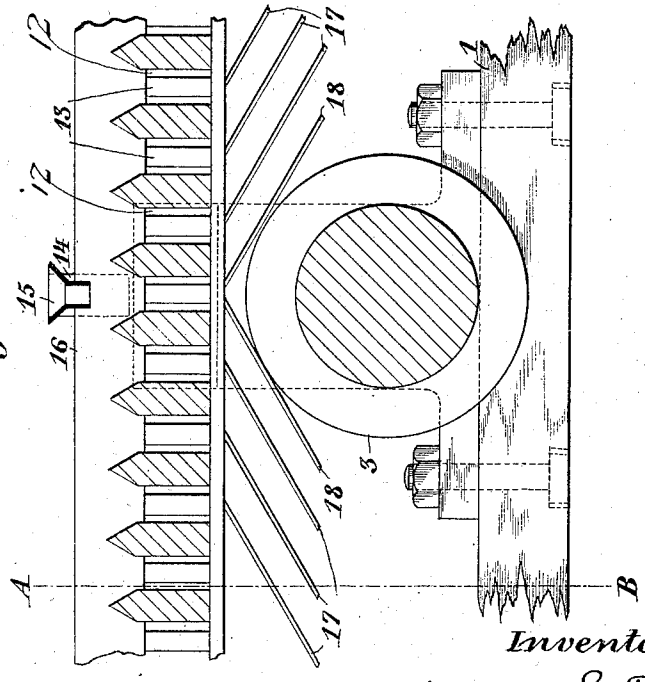


Fig. 1.



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NO MODEL. 4 SHEETS—SHEET 2.

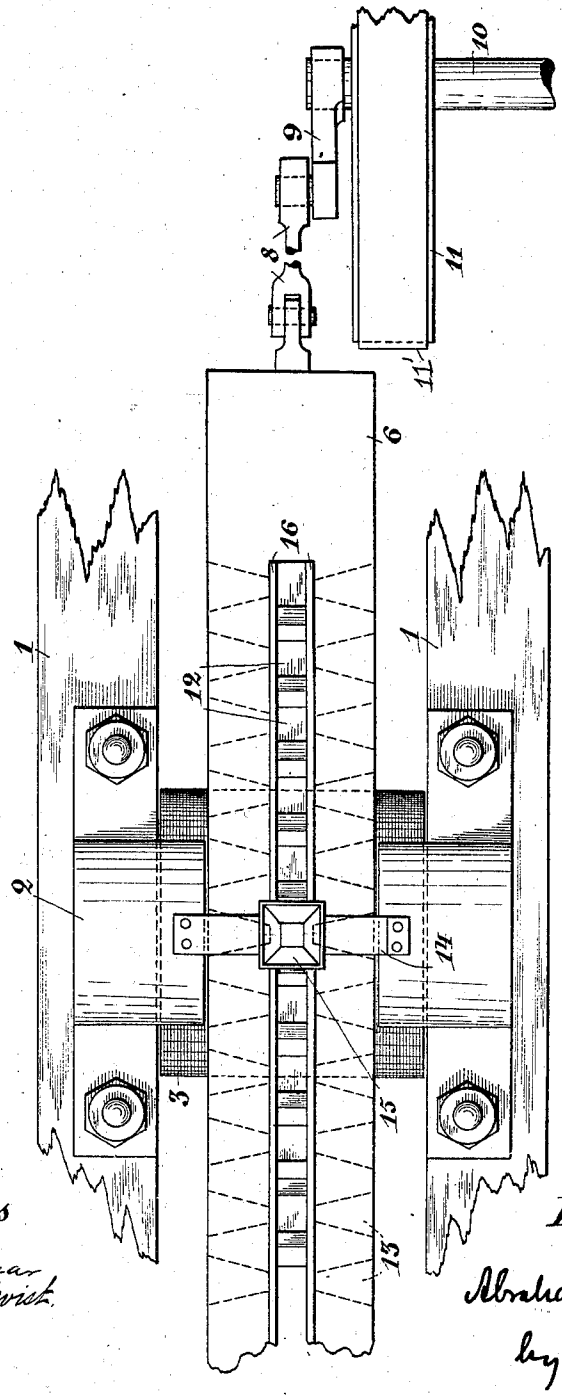


Fig. 2.

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NO MODEL. 4 SHEETS—SHEET 3.

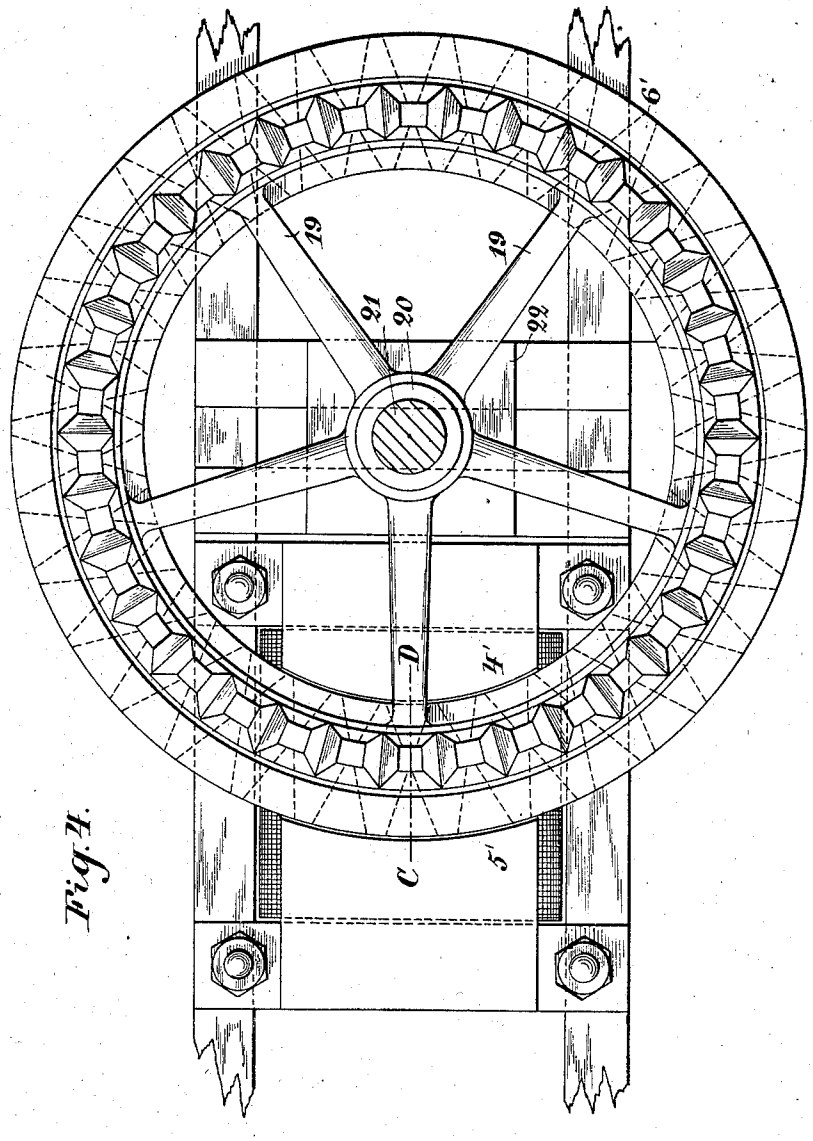


Fig. 4.

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NO MODEL. 4 SHEETS—SHEET 4.

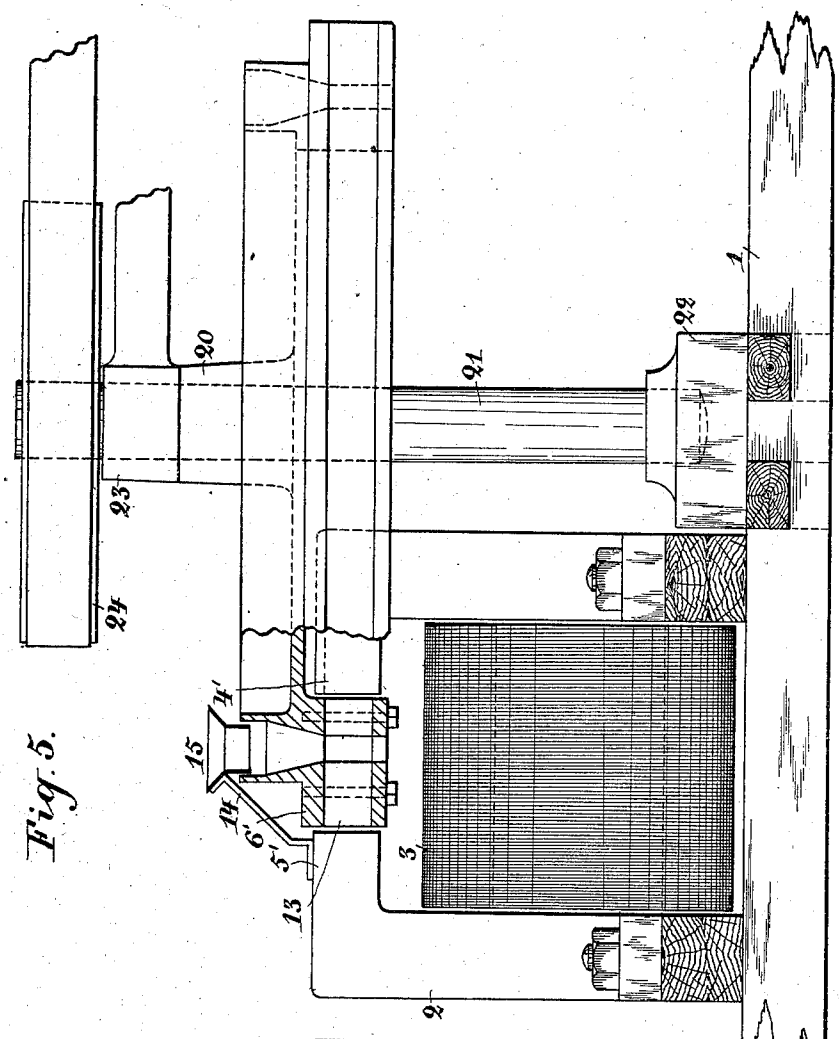


Fig. 5.

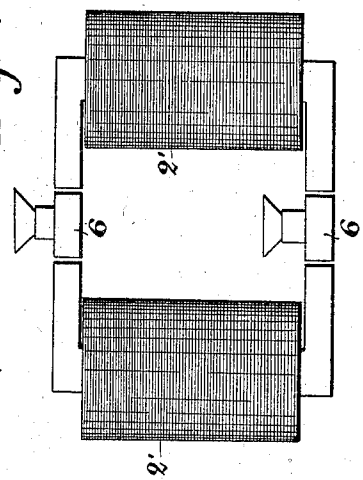


Fig. 6.

Witnesses

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 731,446. Patented June 23, 1903.

UNITED STATES PATENT OFFICE.

ABRAHAM EMIL FORSGREN, OF FALUN, SWEDEN, ASSIGNOR TO ANDERS ERIC SALWÉN, OF GRÄNGESBERG, SWEDEN.

MAGNETIC SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 731,446, dated June 23, 1903.

Application filed January 13, 1902. Serial No. 89,428. (No model.)

To all whom it may concern:

Be it known that I, ABRAHAM EMIL FORSGREN, a subject of the King of Sweden and Norway, and a resident of Falun, Sweden, have invented new and useful Improvements in Magnetic Separators, of which the following is a specification, reference being had to the drawings accompanying and forming a part hereof.

This invention relates to improvements in magnetic separators, and more especially to that kind of magnetic separators in which secondary magnet-poles are arranged to run close to the pole-surfaces of one or more primary magnet-poles, so as to carry the magnetic material out from the magnetic field or fields created by the said primary magnet-poles.

The object of my invention is to provide a magnetic separator of the said kind which will be simple in construction as well as reliable in its function.

The invention consists chiefly in arranging the secondary magnet-poles opposite each other in two rows in a frame movable between the primary magnet-poles and in making an intermediate row of openings in said frame in such manner that each opening will be placed between two opposite secondary poles, the magnetic material being adapted to be fed into the said openings when the same pass through the magnetic field of the primary magnet-poles. By this arrangement the magnetic material will be caught in the said openings in a more effective manner than in magnetic separators of the above-mentioned kind heretofore known. The walls between the said openings will prevent the magnetic material from remaining in the magnetic field of the primary magnets.

In the accompanying drawings, in which like reference-figures are used to denote same or corresponding parts throughout, I have illustrated various devices embodying my invention.

Figure 1 shows a vertical section of a separator according to the present invention; Fig. 2, a plan view of the same; Fig. 3, a section on line A B in Fig. 1; Fig. 4, a plan view of another constructional form; Fig. 5, an elevation, partly in section, the section being taken on line C D in Fig. 4. Fig. 6 shows diagrammatically a third constructional form of my invention.

Referring to Figs. 1 to 3, to a suitable base or frame 1 is attached a field-magnet 2, having an electric winding 3. Between the poles 4 and 5 of said field-magnet is arranged a reciprocating frame 6, preferably made of non-magnetic material, such as zinc, and movable in suitable guides 7. To one end of said frame is pivotally connected a rod 8, which is also pivotally connected to a crank 9 of a shaft 10, which may be driven, for instance, by a belt-pulley 11, fixed to the same, and a belt 11′, running on said pulley. The said frame 6 is provided with a number of holes or openings 12, in which the magnetic and non-magnetic material is adapted to fall down and which for this purpose preferably are wider at their upper ends. In the frame 6 are further inserted two rows of pole-pieces 13, arranged opposite each other, the outer ends of said pole-pieces 13 running close to the surfaces of said primary poles 4 and 5. The inner ends of said pole-pieces 13, which preferably may be of smaller cross-section than the outer ends of the same, lie uncovered in the said openings 12. To the upper side of the field-magnet 2 is, by means of suitable brackets 14, attached a hopper 15, preferably arranged above the row of openings 12 of the frame 6. In order to prevent the material fed into the said hopper 15 from falling out to the side upon the said frame 6, the latter is provided with two flanges 16, surrounding the lower mouth of said hopper 15. Below the said frame 6 and at both sides of the field-magnet 2 is provided a number of inclined planes 17 18, on which the mixture of magnetic and non-magnetic material is adapted to fall down and which serve to separate the magnetic material into several different grades, as well understood.

The working of the above-described apparatus is as follows: The frame 6 is put in motion by any suitable power by means of the belt 11′, and the mixture of magnetic and non-magnetic material is fed into the hopper 15. From the hopper the material will drop down into those openings 12 that are for the moment below the said hopper, whereby the

said non-magnetic material will drop directly through the said openings down to the inclined planes 18, whereas the magnetic material will adhere to or be held by the secondary pole-pieces 13 and in the movement of the frame 6 will gradually be carried out of the magnetic field until it drops down onto the inclined planes 17 as the said pole-pieces lose their magnetism.

Referring to Figs. 4 and 5, the frames supporting the secondary pole-pieces 13 are in the form of a horizontal ring 6′, connected by means of spokes 19 to a nave 20, which is fixed to a vertical shaft 21, supported in a foot-bearing 22 and a box-bearing 23. Above the latter the shaft is provided with a pulley 24, by means of which the frame 6′ may be rotated. The field-magnet 2 is arranged in such manner with respect to the said frame 6′ that the latter will run between the magnet-poles 4′ and 5′, the pole-surfaces of the latter for this purpose being formed after the outside respectively the inside of the frame 6′. The hopper 15 is arranged at the side of the field-magnet poles in such manner with respect to the direction of movement of the frame that the magnetic material caught by the pole-pieces 13 must pass through the magnetic field between the primary magnet-poles 4′ and 5′. Though only one pair of primary magnet-poles is shown in each apparatus, two or more pairs of such magnet-poles may be used.

Fig. 6 shows diagrammatically a third constructional form of my invention, in which two electromagnets 2 are used, arranged so as to create two distinct magnetic fields, in each of which is provided a movable frame 6 with secondary poles 13.

It is obvious that a separator according to my present invention may be used whenever magnetic material is to be extracted or separated from a mixture of magnetic and non-magnetic material, be it iron ore or any other material, such as clay containing iron particles.

Having now described my invention, what I claim as new, and desire to secure by United States Letters Patent, is—

The combination with a magnetic ore-separator having primary and secondary magnet-poles movable in relation to each other, of a frame arranged to move between said primary magnet-poles, two rows of secondary pole-pieces fixed opposite each other in said frame, and an intermediate row of openings in said frame each opening being arranged between one pair of said secondary magnet-poles, substantially as and for the purpose set forth.

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

ABRAHAM EMIL FORSGREN.

Witnesses:
EVALD DELMAR,
GERDA LINDKVIST.