No. 676,840. Patented June 18, 1901.

T. A. EDISON.

MAGNETIC SEPARATING APPARATUS.

(No Model.) (Application filed Jan. 9, 1900.)

Fig. 1

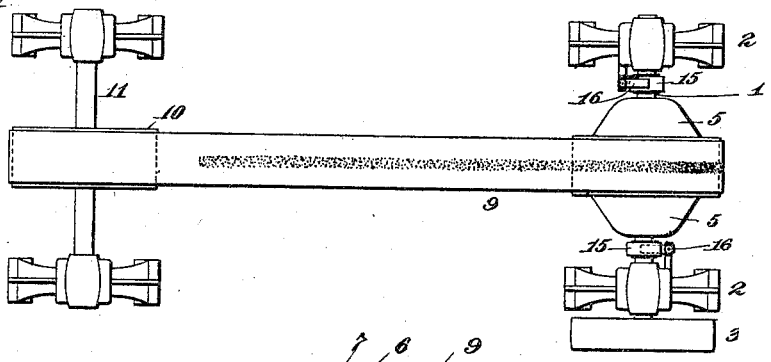



Fig. 2

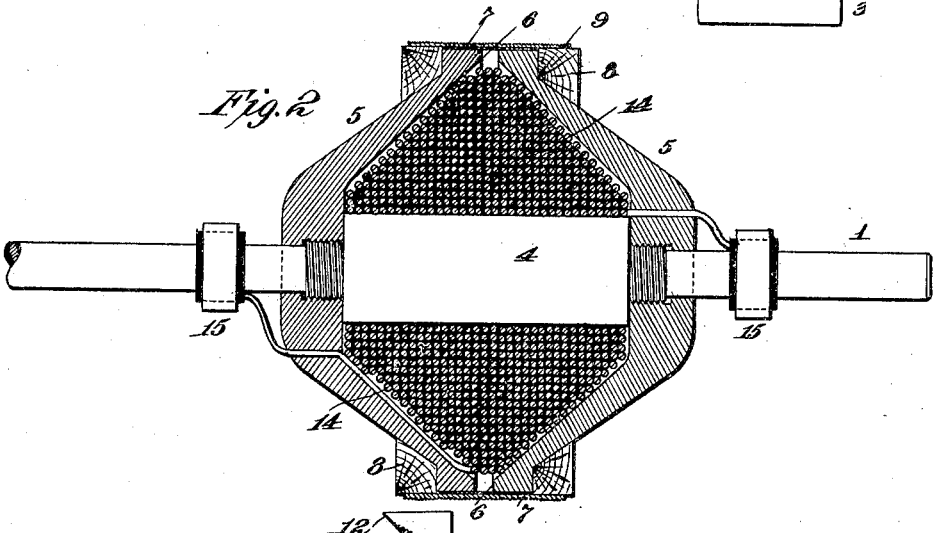
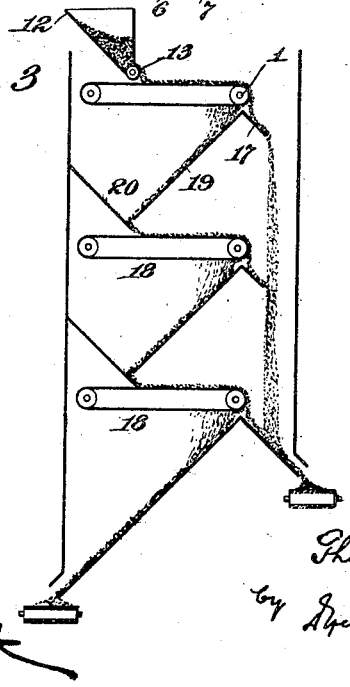



Fig. 3




Witnesses:

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# UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY.

## MAGNETIC SEPARATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 676,840, dated June 18, 1901.

Application filed January 9, 1900. Serial No. 822. (No model.)

*To all whom it may concern:*

Be it known that I, THOMAS A. EDISON, a citizen of the United States, residing at Llewellyn Park, in the county of Essex, State of New Jersey, have invented a certain new and useful Improvement in Magnetic Separating Apparatuses, of which the following is a description.

My invention relates to improved apparatus for separating magnetic particles from non-magnetic particles; and the invention is particularly adapted for use in the separation of particles which are extremely weak magnetically—such as garnets, specular iron ore, &c.

The object of the invention is to provide a magnetic separating apparatus of a simple construction which shall be very rapid in its operation and wherein particles which are extremely weak magnetically can be effectively separated and concentrated.

In carrying my invention into effect I provide a circular magnet of great power, with the poles brought close together, so as to form a relatively narrow gap between them, the magnet constituting a pulley, around which is passed an endless belt, to which belt the mixed magnetic and non-magnetic particles are fed in the proper way. The belt travels in line with the gap between the polar faces of the magnet, so that the magnetic particles will be caused to adhere very tenaciously to the belt until they have passed around and beyond the vertical diameter of the magnet, the magnetic particles being thus carried away from the effect of the magnetic attraction by means of the belt until they drop off, while the non-magnetic particles are permitted to drop away from the belt in front of a suitable deflecting-board as the belt in passing over the magnet gradually approaches and recedes from its vertical direction.

In order that a more perfect separation of magnetic from non-magnetic particles may be effected, I prefer to use a series of the improved separating apparatus, placed one above the other and by means of which the concentrates separated by one of the separators will be successively subjected to the succeeding separators. Thus it becomes possible to feed to the first separator magnetic and non-magnetic particles in great quantities, the failure of the first magnetic separator to remove all of the non-magnetic particles being corrected in the succeeding separator or separators.

The invention also contemplates various improvements in details, as will be more fully hereinafter described and claimed.

In order that the invention may be better understood, attention is directed to the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is a plan view of the preferred embodiment of my improved magnetic separator; Fig. 2, a sectional view through the magnet, and Fig. 3 a diagram showing three of the separators used in series.

In all of the above views corresponding parts are represented by the same numerals of reference.

Each separator comprises a shaft 1, mounted in bearings 2 2 and to which power is applied—as, for instance, at a belt-wheel 3. The shaft 1 is provided with an enlarged cylindrical portion 4, comprising the core of the magnet. The poles of the magnet 5 5 are dished, as shown, being gradually tapered to the polar faces 6 6, which extend parallel with each other to form a relatively narrow gap between them. This gap is covered with a thin sheet 7 of non-magnetic material, such as brass.

8 8 are wooden or other non-magnetic rims which are mounted outside of the polar extremities 6 6 of the magnet and which, together with the magnetic faces, support a conveying-belt 9, passing over a pulley 10, mounted on a shaft 11. Material is fed to the belt 9 in any suitable way—as, for instance, from a hopper 12—by means of a roller-feed 13, the width of the feed 13 being only sufficient to feed a stream of material to the belt 9 at portions thereof substantially coincident with the gap between the polar faces 6, as indicated in Fig. 1. Thus the magnetic material carried by the belt 9 in intimate proximity to the polar faces of the magnet will be subjected to an intense magnetic field. The poles 5 5 inclose the magnetizing-coil 14, which is wound as a bobbin on the core 4, electrical connections to said coil being made through insulated collecting-rings 15 and ordinary brushes 16. The number of ampere-turns of the coil 14 is so proportioned relative to the mass of the mag-

nets and the taper of said magnets toward the polar extremities 6 6 is so made, that these polar extremities will be magnetically saturated. Preferably the belt 9 is made of some material having an uneven surface, such as heavy canvas duck, as indicated generally in Fig. 2, whereby the magnetic materials carried on the belt will be prevented from being dissipated to either side of the relatively narrow path of deposit and will be thus always kept during the operation of separation in the influence of the lines of intense magnetic force bridging the gap between the polar extremities of the magnets. When the improved separator is used for the separation of particles which are extremely weak magnetically—as, for instance, garnets or specular iron ore—the speed of the belt 9 will be relatively slow—for instance, from twenty to fifty feet per minute—in order that the centrifugal effect may not tend to throw the weak magnetic particles away from the surface of the belt. When the magnetic particles are stronger magnetically, however, the speed of the belt may be increased without danger of the centrifugal force dislodging the magnetic particles.

In applications filed on even date herewith I describe a process and apparatus for use in the separation of magnetic particles having a relatively high magnetic affinity, such as magnetite, and wherein the belt is driven at a sufficiently high speed as to result in the generation of enough centrifugal force to cause the non-magnetic particles to be thrown off of the belt as it passes around the turning magnet, and I therefore do not claim such a process or such a specific apparatus herein.

Mounted beneath the magnet, preferably slightly in advance of its vertical diameter, is a deflecting-board 17, the non-magnetic particles falling in front of the board and the magnetic particles falling behind it. Preferably one or more additional separators 18 may be located below the separator which has been specifically described and to which the concentrates from each separator will be successively supplied. Thus a chute 19 may be employed to convey the concentrates to a hopper 20 from each separator and for feeding the concentrates upon the belt of the separator immediately below, as will be understood.

The operation is as follows: The belt 9 is moved around the magnet, which acts as a pulley—as, for instance, by applying power to the shaft 1 at the belt-wheel 3. The mixed magnetic and non-magnetic particles are fed to the belt in a narrow path by the roller-feed 13, the feed being preferably no greater than the gap between the polar faces of the magnet when the separator is used in connection with magnetic particles which are extremely weak magnetically. As soon as the magnetic particles are influenced by the lines of magnetic force bridging the gap between the polar extremities such particles will be held tenaciously against the belt and will be carried thereby around the magnet, while the non-magnetic particles will drop off in front of the deflecting-board 17, as will be understood. As the magnetic particles held against the belt by the magnetic attraction pass the vertical diameter of the magnet they will be gradually moved away from the effect of the magnetic attraction by the stripping action of the belt until they fall off on the rear side of the deflecting-board. By using a series or bank of separators, as shown in Fig. 3, it is possible to feed to the first separator magnetic and non-magnetic particles in great quantities, any non-magnetic particles which are not separated at the first separator being separated from the magnetic particles in the succeeding separators.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is as follows:

1. In a magnetic separator, the combination of a magnet comprising two dished members having polar extremities which are arranged adjacent to each other with a relatively narrow gap between them, non-magnetic rims rigidly carried by said members and arranged parallel with the polar extremities, and a belt carried by said rims and said polar extremities and to which the mixed magnetic and non-magnetic materials are fed, substantially as set forth.

2. In a magnetic separator, the combination of a horizontally-mounted rotatable core carrying a coil, two dished members carried by the core and surrounding said coil, said members being formed with annular pole-pieces which are mounted close together with a narrow gap between them, a thin plate of non-magnetic metal inclosing said annular pole-pieces, annular non-magnetic rims carried by said members and arranged parallel with said pole-pieces and flush with said non-magnetic plate, and a belt carried by the plate and said non-magnetic rims, substantially as set forth.

This specification signed and witnessed this 3d day of January, 1900.

THOMAS A. EDISON.

Witnesses:
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