No. 675,162. Patented May 28, 1901.

B. NOBLE.

MAGNETIC SEPARATOR.

(Application filed Aug. 27, 1900.)

(No Model.)

Fig. 4.

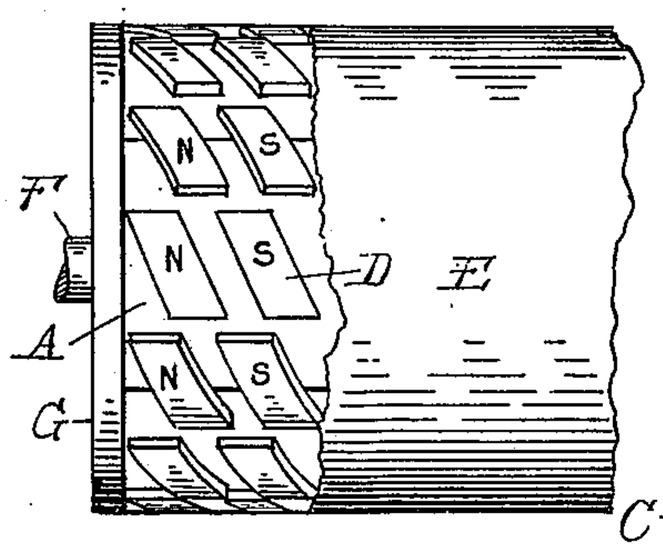


Fig. 2.

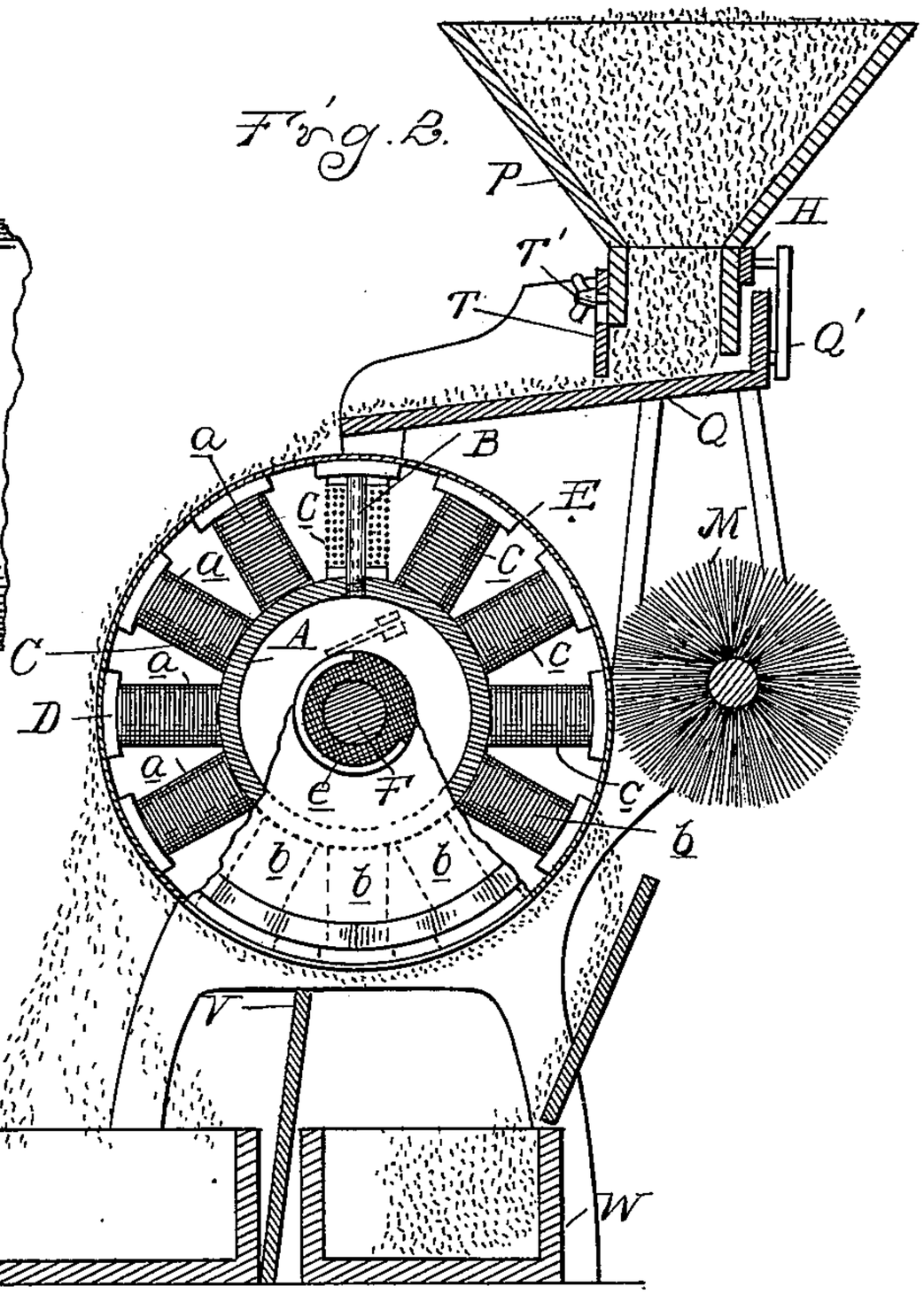


Fig. 1.

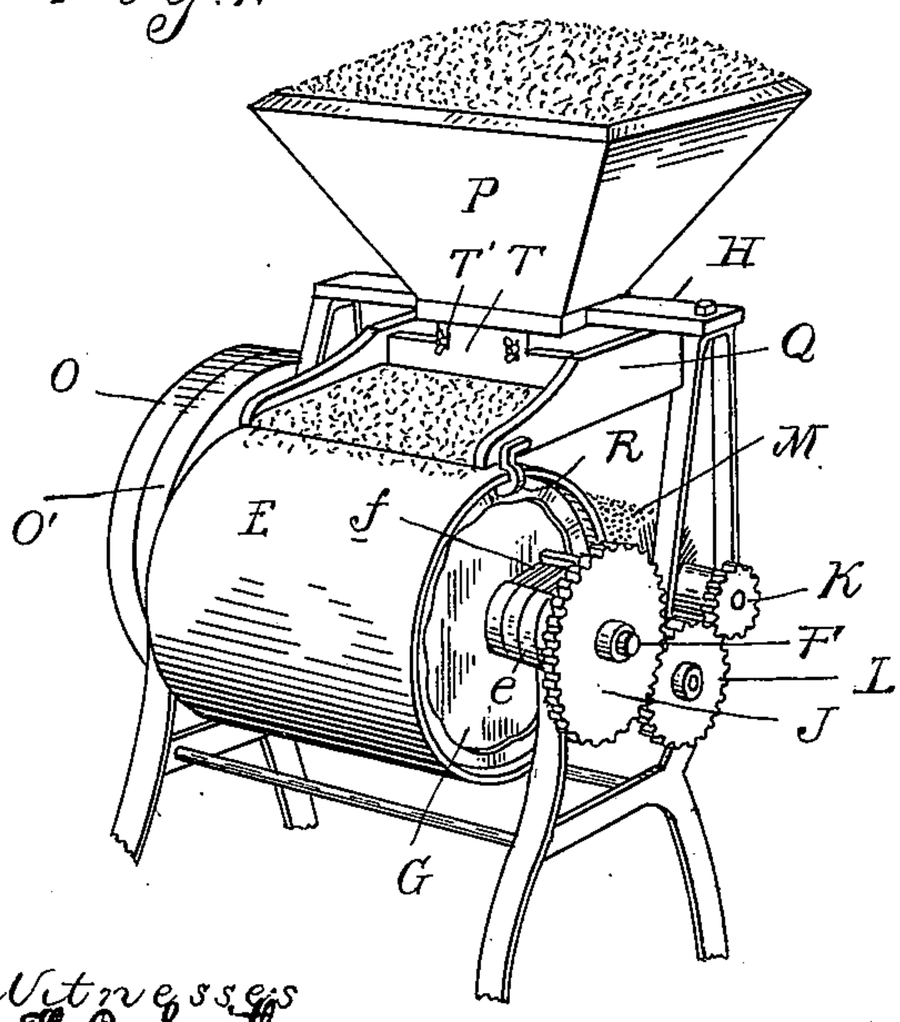
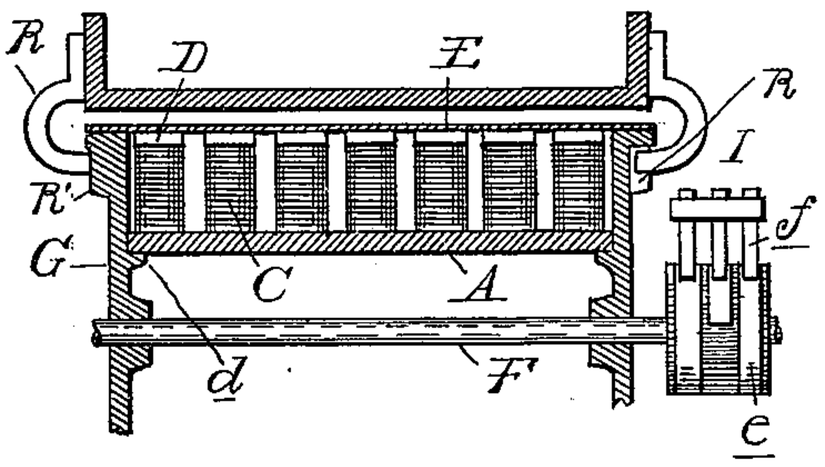


Fig. 3.



Witnesses
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UNITED STATES PATENT OFFICE.

BENJAMIN NOBLE, OF DETROIT, MICHIGAN, ASSIGNOR OF ONE-HALF TO JOHN G. DIETZ, OF SAME PLACE.

MAGNETIC SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 675,162, dated May 28, 1901.

Application filed August 27, 1900. Serial No. 28,193. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN NOBLE, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Magnetic Separators, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to magnetic separators especially designed for separating iron filings and chips from brass, copper, or other practically non-magnetic metals.

It is the object of the invention to obtain a machine simple and inexpensive in construction and efficient in operation; and to this end the invention consists of the peculiar construction and arrangement of parts, as hereinafter described and claimed.

In the drawings, Figure 1 is a perspective view of a separator. Fig. 2 is a vertical cross-section therethrough. Fig. 3 is a longitudinal section through the separating-cylinder, and Fig. 4 is an elevation thereof with a portion of the sheathing removed.

A is a cylindrical shell formed of iron and preferably cast.

B represents iron studs extending radially from the cylinder A and preferably arranged in longitudinal and circumferential series. These studs are preferably formed of soft iron and are screwed or otherwise secured in apertures in the cylinder A. Upon each of the studs B is arranged a helix or coil C of insulated wire adapted upon the passage of the electric current therethrough to convert said stud into an electric magnet. These coils are connected in circuit in such a manner as to alternately form opposite poles at the outer ends of the studs, while the cylinder A forms a magnetic coupling between the inner ends of the studs, thus forming in effect a series of horseshoe-magnets. The circumferential series of coils are divided into a plurality of sections adapted to be connected into different electric circuits. In the drawings I have shown three sections, the magnets of which are respectively indicated by the letters *a*, *b*, and *c* and which are connected to a commutator, as will be hereinafter described. At the outer ends of the studs B are secured pole-pieces D. These, as shown in Fig. 4, are formed of metallic plates convex on their outer faces, so as to form together an interrupted cylindrical surface. The spaces between the longitudinal rows of pole-pieces form substantially a straight line, but the spaces between the circumferential series are zigzag. This is produced by securing the pole-pieces to extend at an angle to the plane of rotation, as shown in Fig. 4. Surrounding the pole-pieces D is a sheathing E, formed of brass or any suitable practically non-magnetic substance. The cylinder A is mounted upon a shaft F by means of the heads G, arranged at opposite ends of the cylinder, said heads having lugs or flanges *d* for engaging with the ends of the cylinder. These heads also form a support for the shield E. The shaft F is mounted in a suitable frame H, and at one end of the cylinder is arranged a commutator I. This commutator is provided with three segments *e*, corresponding to three sections of electromagnets C, each segment being preferably substantially about two-thirds of the circle and being arranged to overlap one-third of each of the other segments.

f represents brushes for engaging respectively with the segments *e*.

The cylinder is driven by means of a gear-train comprising the gear-wheel J on the shaft F, the gear-wheel K on a shaft arranged in rear of the shaft F, and an intermediate gear L. The shaft of the gear-wheel K carries a rotary brush M, which is adapted to contact with the surface of the shield E and rotates in opposite directions therefrom. To communicate motion to the gear-train, fixed and loose pulleys O and O′ are secured to the brush-shaft and are adapted to be connected by a suitable belt with a source of power. Above and in rear of the cylinder is supported upon the frame H a hopper P, into which the material to be separated is fed. Beneath this hopper is arranged a vibrating pan or spreader Q, pivotally secured by links Q′ at its rear end to the frame and at its forward end resting upon the sheathing E.

R represents fingers secured to the opposite sides of the spreader Q and extending in proximity to the heads G. At opposite ends of

the cylinder are cams or lugs R′, formed on the heads G, adapted in the rotation of the cylinder to engage with the fingers R, and thereby to impart a lateral oscillatory movement to the spreader.

The construction of parts being as above described, in operation the hopper is filled with the chips or filings to be separated and motion is imparted through the pulley O to the cylinder and brush. The rotation of the cylinder will impart a vibratory movement to the spreader, which will feed a thin layer of the material upon the sheathing E. By means of suitable electric circuits (not shown) the magnet C of two of the sections (*a b*, Fig. 2) are energized, so that the magnetic material deposited on the sheathing will be carried around through a two-thirds revolution of the cylinder, while the non-magnetic material, such as copper or brass, will drop off into the receptacle U at the front of the machine. In the further revolution of the cylinder after the section *b* has completely passed the division-board V the magnets thereof will be cut out of circuit by the commutator, allowing the magnetic material adhering to the shield to drop into the receptacle W. Should any fine particles still adhere, the brush H will disengage them. Simultaneously with the cutting out of the section *b* the section *c* (which in the position shown in Fig. 2 is deënergized) will be thrown into the circuit before the first of its magnets passes beneath the front edge of the spreader Q. Thus the operation may be continued as long as desired and the magnetic and non-magnetic material will be separated.

The object of making the pole-pieces D of the form shown in Fig. 4 is to form in effect during the rotation of the cylinder a magnetic pole extending the complete width of the machine. This will prevent the possibility of any magnetic particles escaping the magnetic action in the spaces between the adjoining magnets, and the result is that before the non-magnetic material is deposited in the receptacle U all magnetic particles have been eliminated therefrom.

In order to distribute the material from the hopper uniformly over the pan Q, I preferably arrange a gate-board T, which is vertically adjustable and secured by thumb-screws T′. This will permit of the adjustment of the size of the opening beneath said gate according to the fineness or coarseness of the material to be separated.

What I claim as my invention is—

1. In an electromagnetic separator, the combination of an iron cylinder, iron studs secured to and projecting radially from said cylinder and arranged to form a circumferential and longitudinal series of pairs, coils upon said studs connected in electric circuit to form magnets alternately of opposite polarity in both circumferential and longitudinal series, all of said magnets being magnetically coupled by said cylinder, whereby a substantially complete magnetic circuit may be formed by the separated magnetic material bridging between any pair of opposite poles, and a non-magnetic sheathing surrounding said studs and coils.

2. An electromagnetic separator comprising a cylinder, a series of magnetically-interconnected horseshoe-electromagnets secured to said cylinder and having their poles extending radially therefrom and arranged in longitudinal and circumferential series being alternately of opposite polarity, segmental pole-pieces at the outer end of said magnets inclined to form zigzag separating-space between the adjacent circumferential series, the ends of the pole-pieces of one longitudinal series being opposite and extending completely across the spaces of the adjacent longitudinal series whereby in the rotation of said pole-pieces a complete cylindrical surface is traced, and a non-magnetic sheathing surrounding said pole-pieces.

In testimony whereof I affix my signature in presence of two witnesses.

BENJAMIN NOBLE.

Witnesses:
M. B. O'DOGHERTY,
H. C. SMITH.