(No Model.)

C. G. BUCHANAN.

MAGNETIC ORE SEPARATOR.

No. 497,117. Patented May 9, 1893.

Fig: 1.

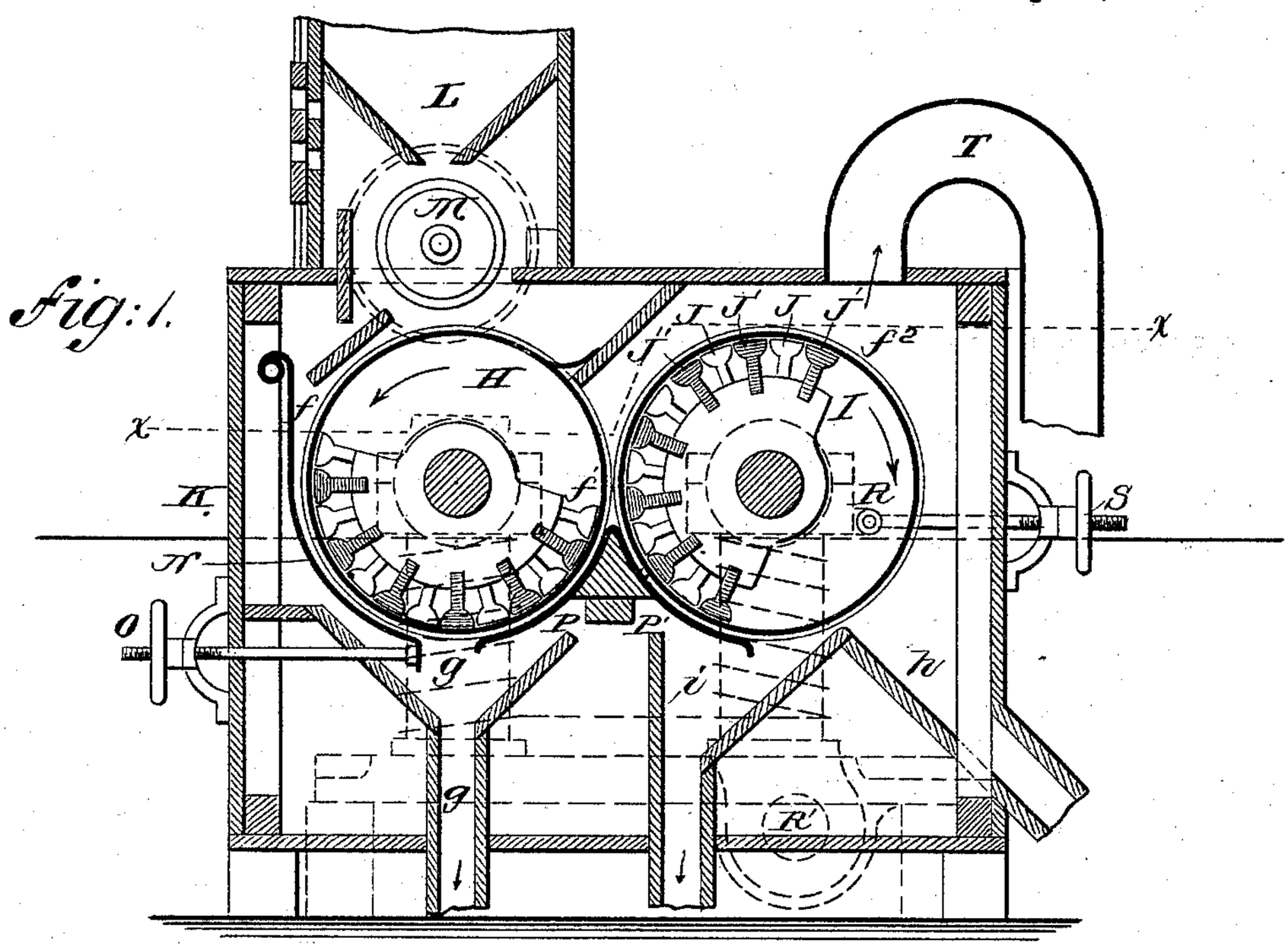
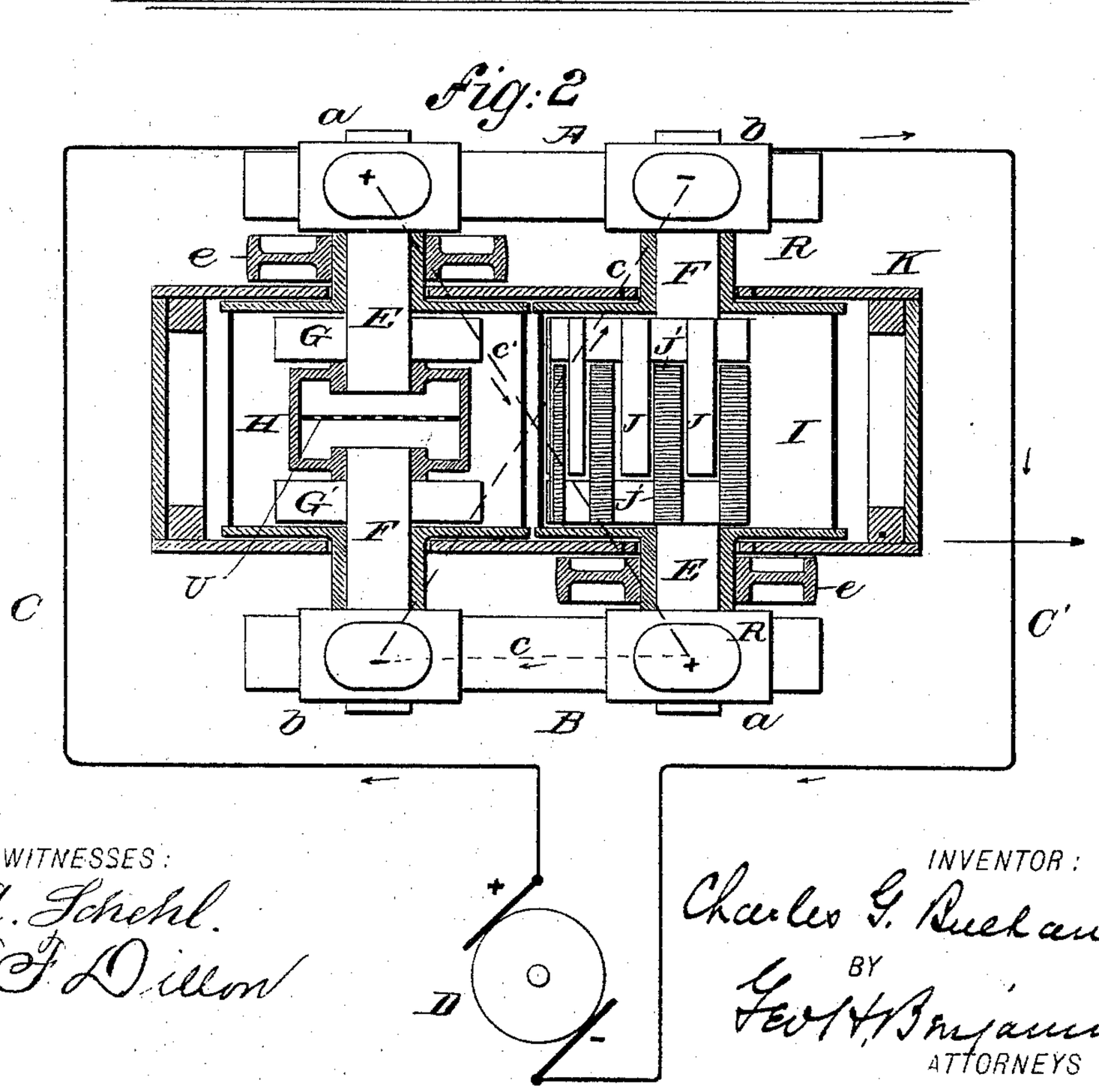


Fig: 2.



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UNITED STATES PATENT OFFICE.

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MAGNETIC ORE-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 497,117, dated May 9, 1893.

Application filed May 17, 1892. Serial No. 433,348. (No model.)

To all whom it may concern:

Be it known that I, CHARLES G. BUCHANAN, a citizen of the United States, residing at the city, county, and State of New York, have invented new and useful Improvements in Magnetic Ore-Separators, of which the following is a specification.

My invention relates to the separation of iron in ores or from magnetic sands, gangue, or other non-metallic substances, in a dry, pulverized state, which separation is effected by the retention of the metallic particles and the gravitation of the non-metallic particles upon a cylinder, or other surface, subject to a magnetic field.

In my Letters Patent, No. 466,767, dated February 17, 1891, I describe an apparatus wherein the polarity of a series of electro-magnets within a revolving drum or cylinder is reversed during the motion of the latter, for the purpose of retaining the particles of ore and dislodging the non-metallic portions.

The object of the present invention is to accomplish the same purpose by means of stationary magnets of opposite polarity located within a revolving cylinder whereon metallic particles are caused to move past said oppositely polarized magnets arranged in alternating succession.

In all prior constructions of magnetic separators with which I am familiar and wherein stationary magnets are located within the revolving cylinder, the exciting coils of the magnets are also within said cylinder. Such a construction is open to several serious objections, prominent among which may be noted the inconvenience of such an internal arrangement, and the fact that the friction generated by the revolving portion tends to heat the wire of the coils, thereby causing a certain relaxation of the same and rendering them subject to the cutting or deteriorating action of dust particles, which, under such conditions, more readily work between the strands composing the coils. By my present invention, I avoid the difficulties noted by locating the magnetizing coils external to the revolving drum.

My invention further contemplates a pair of drums, revolving in opposite directions, each containing a series of fixed magnetic poles of alternating polarity, the series of poles of one section being differentially arranged with respect to those of the other, whereby the secondary series in connection with the relative oppositely rotating drums, acts to operate on the material as soon as it passes beyond the influence of the primary series, the result being that the metallic particles are carried in a direction opposed to the natural gravital tendency encountered by the gangue or other non-metallic substances beyond the first drum. Further, such an arrangement insures a more effective treatment since the metallic particles are carried up and over the second drum, experiencing a more extended surface treatment than would be possible if both drums revolved in unison.

In the accompanying drawings forming part of this specification, Figure 1, is a vertical, sectional elevation of a magnetic separator embodying my improvements, and Fig. 2, is a horizontal section of Fig. 1, taken in the plane indicated by the dotted lines *x*—*x*, the drum I being in section.

A and B represent magnets located on opposite sides of the apparatus, the legs *a*, *b* of which are oppositely wound with insulated magnetizing coils of wire, so that those of the legs *a*, *a*, form positive poles and those of *b*, *b*, form negative poles. The coils are supplied with currents through circuit wires C, C′, and suitable generator D, the connections being made so that the current will flow as diagrammatically indicated by the dotted lines *c*, *c*′, and arrows adjacent to the wires C, C′. In the upper portions of the legs *a*, *a*, and *b*, *b*, are mounted the stub shafts E, F, for the cylinders, said shafts, as will be readily comprehended, forming polar extensions of the legs *a*, *b*. Interposed between the inner ends of each pair of stub shafts is a magnetic screen U, designed to magnetically isolate the end faces of the shafts. Upon said stub shafts, the drums H, I, are journaled and are rotated through the medium of pulleys *e*, *e*, keyed on sleeves extending through the sides of the case K of the separator. Upon the inner extremities of the stub shafts and within the drums, are located segments G, G′, bearing

oppositely extending and relatively alternating polarized bars J, J′, as shown most clearly in Fig. 2.

The drums and contained parts are located within the case K, and upon the latter, a hopper L is provided for the introduction of the material to be treated. Operating in connection with the hopper is a rotary cylinder M, for equally distributing the material transversely to the drum H. A directing plate N is pivotally suspended at one side of the drum H, and is movable by a screw hand shaft O, to adjust the position of the plate and consequently control the amount of material operated on by the primary drum H. Stationary plates P, P′, are provided beneath and between the drums H, I, to hold and direct the material in operative relation with regard to said drums.

The relative position of the drums H, I, may be varied, and for such purpose the drum I is mounted on movable bearings R, R, adjustable through the medium of hand operated screw shaft S. The extent of adjustments will depend upon the character of the material to be treated.

One manner of providing the adjustable bearings R R, is by making the legs *a b*, independent from the base and providing each leg with an inwardly extending, horizontal trunnion R′, bearing in the magnet base, the openings in the casing being sufficiently large to permit the desired movement of the parts.

T is an exhaust pipe for removing the fine dust or gangue from the apparatus.

As generally mentioned hereinbefore, the magnetized bars in the drum H, occupy a position whereby the series commences at the feed point *f*, and terminates at the point *f′*, where the metallic particles are acted on by the second drum I. The series of magnetized bars of the latter begins at the point *f′*, or in advance of the same, and terminates at the point f^2, or any suitable point beyond the latter.

In operation, the drums H, I, oppositely revolve as indicated by the arrows, and the ore delivered to the surface of the first drum is alternately exposed to the magnetized bars or poles of opposite polarity, so that the metallic portions of the material are made to turn, releasing the gangue and non-metallic elements and allowing the latter to flow into the discharge hopper *g*. The metallic particles on the drum H, are carried to the point *f′*, where they are released and engaged by the drum I, and the separating operation continued. The gangue or non-metallic material carried past the hopper *g*, is liberated or freed from the metallic particles when the latter pass to the drum, said liberated gangue or non-metallic material being directed to hopper *i*, by plate P′. The separation effected by the drum I, will be most complete, since, as before stated, the position of the magnetized bars or poles therein is such that the metallic particles are carried in a direction opposed to the natural gravital descent of the gangue or non-metallic particles, with the result that clean headings will be delivered at *h*.

The location of the magnetizing coils external to the drums H, I, secures the requisite magnetization of the bars J, J′, and avoids the inconvenience of locating the coils within the drum.

I claim—

1. In a magnetic ore separator, the combination of a revolving hollow drum, and a series of stationary poles within the drum having constant opposite polarity, those of one side projecting from a point at one end of the drum, and those of the other side projecting from a point at the opposite end of said drum toward and between one another, interlocking, and inducing coils outside of said drum, substantially as and for the purpose described.

2. In a magnetic ore separator, the combination of a revolving hollow drum, two interlocking segmental series of poles substantially as described within said drum, and two horizontal supporting shafts whereon the drum is journaled, the same projecting through the ends of said drum and bearing the respective series of magnets, and inducing coils outside of said drum.

3. In a magnetic ore separator, the combination with a revolving hollow drum, of two interlocking segmental series of poles of different constant polarity within said drum, two horizontal supporting shafts whereon the drum is journaled, the same projecting through the ends of said drum and bearing the respective series of magnets, a magnetic screen placed between said projecting ends, and inducing coils outside of said drum, substantially as described.

4. In a magnetic ore separator, the combination with a revolving hollow drum, of a segmental series of poles arranged within the same, inducing coils therefor, feed and discharge hoppers, and an adjustable plate arranged near to the periphery of said drum for controlling the supply of material thereto, substantially as described.

5. In a magnetic ore separator, the combination of two parallel hollow drums revolving near each other in opposite directions, and two independent segmental series of poles within the respective drums; the series within the first drum terminating at the part thereof adjacent to the second drum, and the series in the second drum continuing in the course of rotation of said drum beyond the said adjacent part of the first drum, substantially as and for the purpose described.

6. In a magnetic ore separator, the combination of two parallel hollow drums revolving near each other in opposite directions, two

independent segmental series of poles within the respective drums, the series within the first drum terminating at the part thereof adjacent to the second drum, and the series in the second drum continuing in the course of rotation of said drum beyond the said adjacent part of the first drum, and means for adjusting the distance between the said drums, substantially as described.

7. In a magnetic ore separator, the combination of two parallel hollow drums revolving near each other in opposite directions, a series of stationary poles within each drum having constant opposite polarity, those of one side projecting from a point at one end of the drum, and those of the other side projecting from a point at the opposite end of said drum, toward and between one another, interlocking, inducing coils for said poles, and means for adjusting the distance between the said drums, substantially as described.

8. In a magnetic ore separator, the combination of two parallel hollow drums revolving near each other in opposite directions, a feed hopper above the first drum a gangue discharge hopper beneath the same, a second gangue discharge hopper beneath the second drum, an adjustable plate adjacent to the periphery of one of the drums, for delivering the gangue to the said discharge hoppers, and a segmental series of poles within the respective drums, arranged substantially as described.

9. The combination, in a magnetic ore separator, of two parallel hollow revolving drums, two respective segmental series of stationary poles within the drums, each said series composed of sub-series of opposite polarity, stationary polar extensions projecting in the axes of said drums bearing the said sub-series, and mounted upon magnetized legs of opposite polarity, substantially as set forth.

10. The combination, in a magnetic ore separator, of two parallel revolving hollow drums, two respective segmental series of stationary poles within the drums, each said series composed of sub-series of opposite polarity, stationary polar extensions projecting in the axes of said drums bearing the said sub-series, and mounted upon magnetized legs of opposite polarity, the legs of one drum being pivoted at their base, and means provided to adjust the same, substantially as described.

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

CHARLES G. BUCHANAN.

Witnesses:

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WM. H. STEGMAN.