(No Model.)

C. Q. PAYNE.

MAGNETIC ORE SEPARATOR.

No. 348,771. Patented Sept. 7, 1886.

Fig. 1.

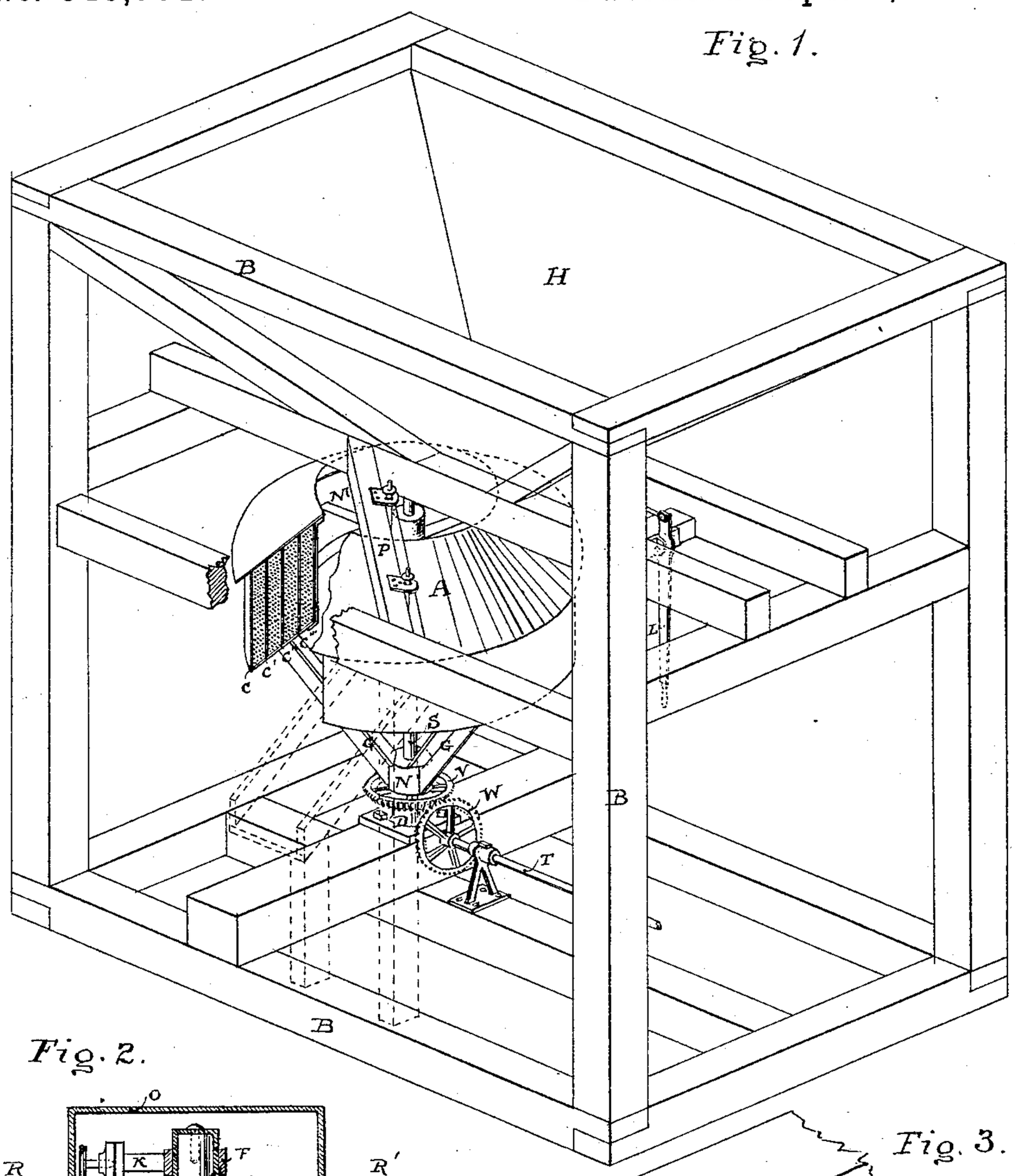


Fig. 2.

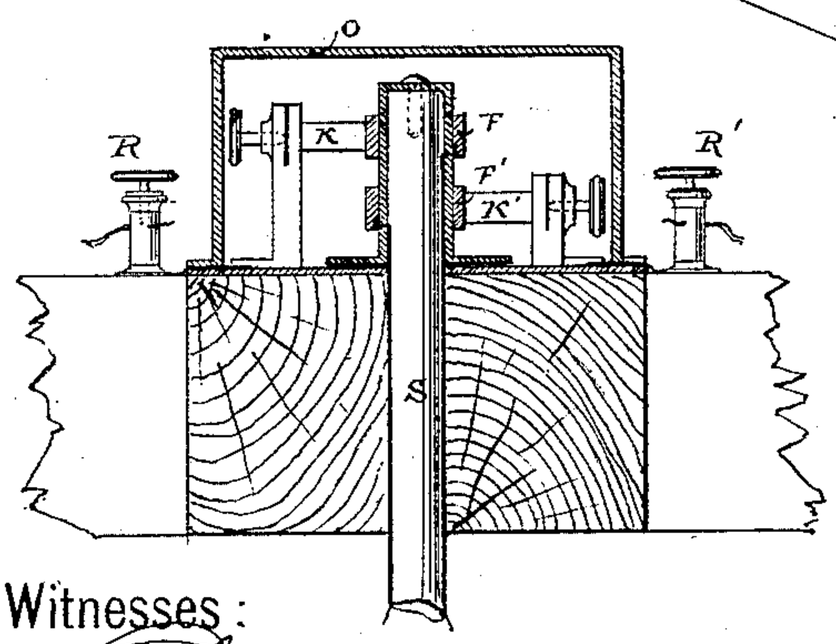
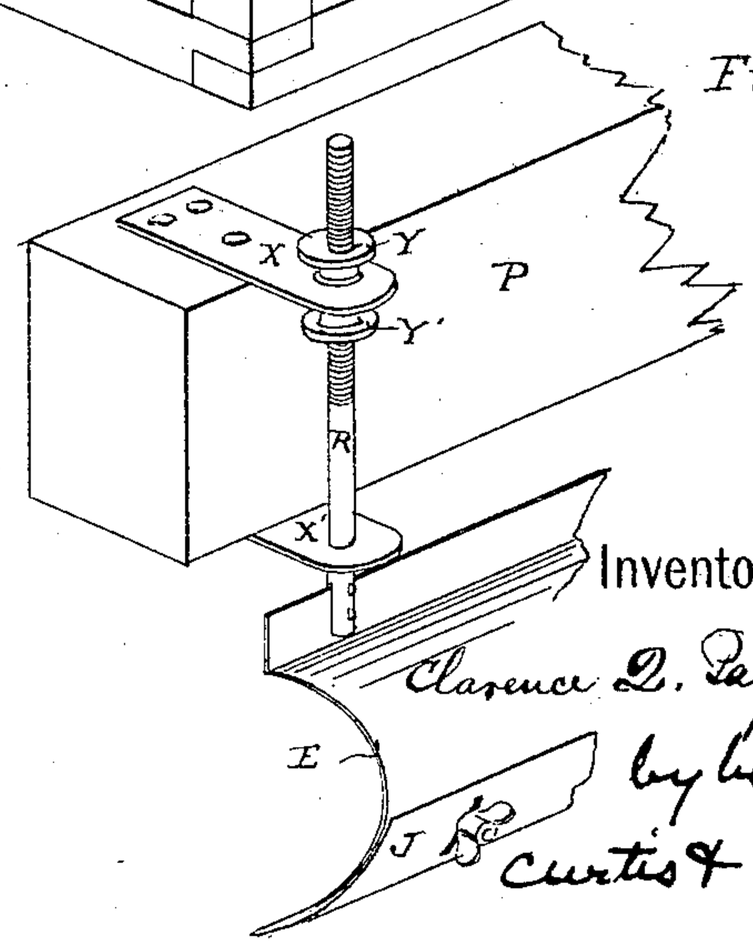


Fig. 3.



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MAGNETIC-ORE SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 348,771, dated September 7, 1886.

Application filed April 8, 1886. Serial No. 198,237. (No model.)

To all whom it may concern:

Be it known that I, CLARENCE QUINTARD PAYNE, a citizen of the United States, residing at Stamford, in the county of Fairfield and State of Connecticut, have invented a new and useful Machine for the Separation or Concentration of Magnetic Iron Ore, of which the following is a specification.

The object of my machine is to effect the concentration of lean magnetic iron ores in the form of sand or ore which has first been crushed and sized by the separation of the magnetic particles by electro-magnetic attraction, while the non-magnetic particles are removed by centrifugal force, thus producing a more complete and rapid separation than has hitherto been possible.

In the drawings illustrating my invention, Figure 1 is a general isometric view of the machine and the frame-work supporting it. Fig. 2 shows a cross-section of the upper end of the shaft upon which the separator is mounted, and the connections which are necessary in order to maintain electrical connection while the shaft is revolving. Fig. 3 shows one end of the scraper by means of which the separated ore is removed from the magnetic surface of the machine.

In Fig. 1 the frame-work B B B forms not only a support for the machine, but also for a hopper, H, above it, from which the ore to be concentrated is fed upon the machine. A lever, L, operates a valve at the bottom of the hopper and regulates the discharge of the ore from the same. The shaft S is mounted vertically upon a bottom step, D, and held at the top by a suitable bearing, through which it projects, the upper end of which (*i.e.*, of shaft) is shown in Fig. 2 in detail. Mounted upon this shaft are a series of concentric iron tubes or cylinders, *c c' c''*, which are slit longitudinally. These are shown in section in the part of the machine broken away to show its construction. The inner cylinder is bolted to the flat face of a pulley, M, which is keyed to the shaft S. The upper ends of these cylinders may be either horizontal or may form any convenient angle with a horizontal plane. The lower ends of the cylinders rest upon an annular plate, and are supported by the inclined legs G G, the ends of which are inserted in a casting, N. Between the cylinders *c c' c''*, &c., copper wire is wound continuously, as shown in section in Fig. 1, and connected to the copper rings F F, as hereinafter described. A cover, A, of hard brass, rests upon the upper ends of the cylinders, and is permanently riveted to the outer and inner cylinders of the series by angle-pieces. When an electric current from a galvanic battery or dynamo-electric machine is passed through the coils of copper wire, the cylinders become magnetized, and each end forms a continuous circular pole, the succeeding ones of the series being alternately north and south. The lower poles are closed by the plate upon which they rest.

From the above description it will be seen that the separator consists, essentially, of a series of hollow electro-magnets placed one within the other, and that the cover A forms a practically continuous magnetic surface.

The machine is made to revolve with the shaft S by power transmitted through the shafting T and bevel-gears V W.

Referring now to Fig. 2, I have here in cross-section a simple device for making electrical connection of the rotating copper coils in the machine with the dynamo-electric machine or battery. The upper end of the shaft S has a non-conducting covering of wood or rubber, to which two copper rings, F F', are attached. The two ends of the copper wire which form the continuous coil in the magnets, carefully insulated, are carried in grooves along the shaft S and connected separately to the rings F F'. The brass springs K K' are held in suitable supports and allowed to press against the rings F F'. The current passes from the binding-screw R to the spring K and ring F, thence through the coils of copper wire in the machine, and back to the ring F', spring K', and binding-screw R', thus closing the circuit. The cover O serves to protect the copper rings, &c., from dust when the machine is in operation.

In Fig. 3 is shown an enlarged view of one end of the scraper indicated at P in Fig. 1, the object of which is to remove the separated ore from the cover A. The scraper consists of a half-cylindrical steel spring, E, the upper edge of which is flanged. A screw-rod, R,

is bolted to this flange at each end of the spring, and is held in guides X X′, as shown in Fig. 3. The two milled clamp-nuts Y Y′ on the rods R R′ press against the opposite sides of the guide X and serve to adjust the pressure of the spring. The edge of the scraper which presses upon the cover A is formed by a brass plate, J, which has the same curve as the spring E, and to which it is firmly held by bolts and thumb-nuts, such as indicated in Fig. 3. Slots in the plate J allow it to be moved forward for adjustment as the scraping-edge is worn.

The construction and details of the machine being thus explained, the operation of concentrating the ore is as follows: The valve at the bottom of the hopper H is opened and a regulated stream of ore is allowed to fall upon the revolving surface A of the separator. The magnetic particles in the ore are at once attracted and held to this surface, and are carried by the revolution of the separator about its shaft about three-quarters of a complete revolution, when they are removed by the scraper P and discharged to one side of the machine by a chute. (Indicated in dotted lines in Fig. 1.) The sand and other non-magnetic particles, on the other hand, striking the surface of the separator, partly slide down the surface of the cover A, and are collected and discharged by a circular trough at the rear of the machine. (Not indicated in the drawings.) The non-magnetic portion of the ore, however, which is held mechanically by the magnetic particles on the cover A, is thrown off by the action of centrifugal force as it is carried around by the revolution of the separator. By varying the electro-motive force of the current from the battery or dynamo-electric machine, and also the number of revolutions of the machine, the two forces of attraction and separation can be so adjusted as to effect a sharp and thorough separation between the magnetic and non-magnetic portion of the ore to be concentrated.

What I claim as my invention, and wish to secure by Letters Patent, is—

1. In a magnetic separator, a series of hollow cylindrical magnets placed one within the other and mounted upon a vertical shaft constructed to revolve, substantially as described.

2. In a magnetic separator, a number of magnets the poles of which form an annular or conical surface, said magnets being mounted upon a shaft, so as to revolve about the axis of the annulus or cone, substantially as described.

3. In a magnetic separator, a series of hollow concentric iron cylinders mounted upon a vertical shaft, so as to revolve about their common axis, the upper ends or poles of which cylinders form part of an annular or conical surface, in combination with wires or electrical conductors wound between said cylinders, substantially as described.

4. The method of separating magnetic from non-magnetic particles, consisting in subjecting the mixed particles to magnetic attraction acting on the former and centrifugal force upon the latter, the two forces acting in opposite directions—that is, in directions forming with each other an angle greater than a right angle—substantially as described.

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