

No. 708,187.

Patented Sept. 2, 1902.

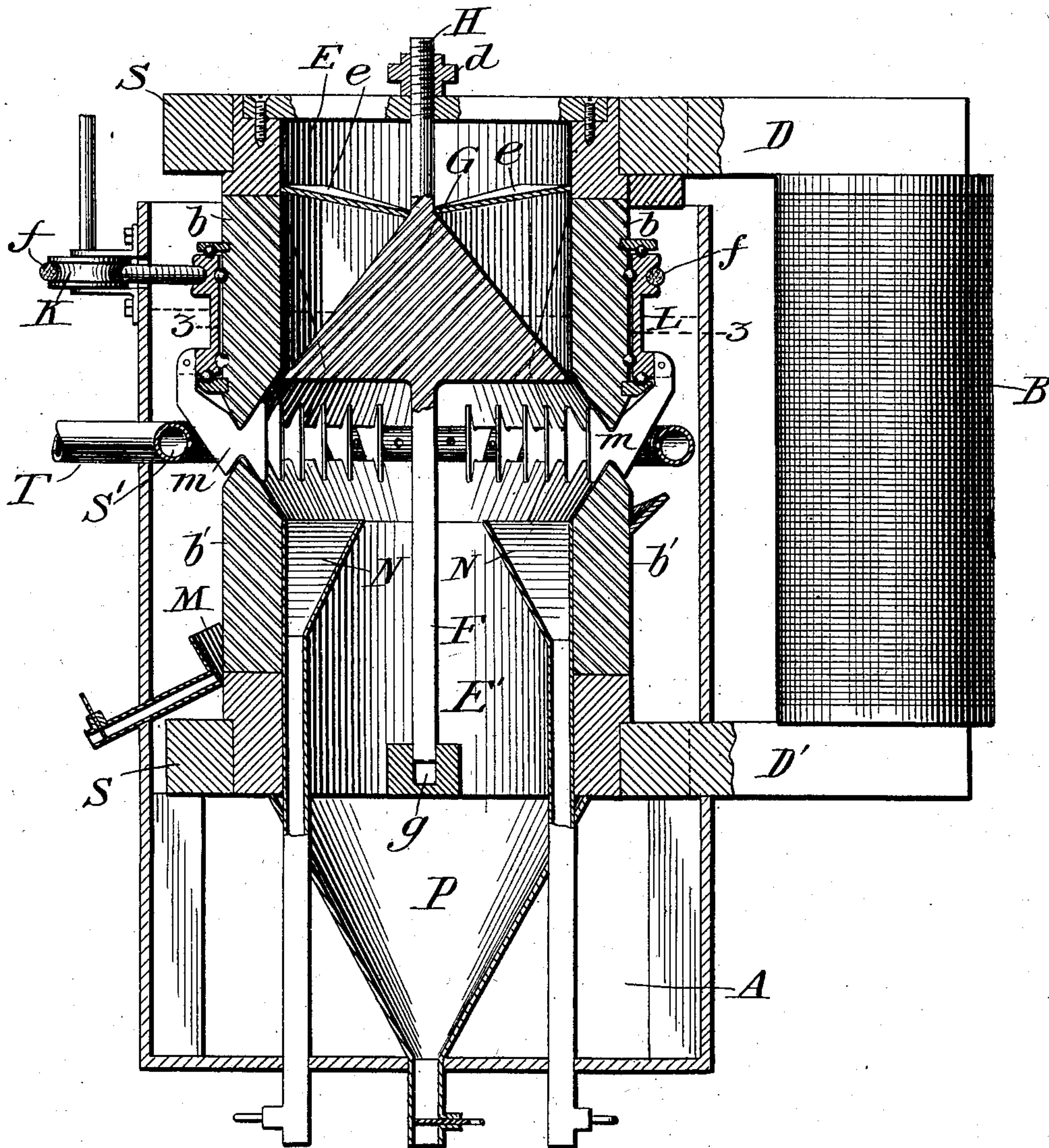
J. P. WETHERILL.
MAGNETIC SEPARATOR.

(Application filed Aug. 26, 1901.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1.



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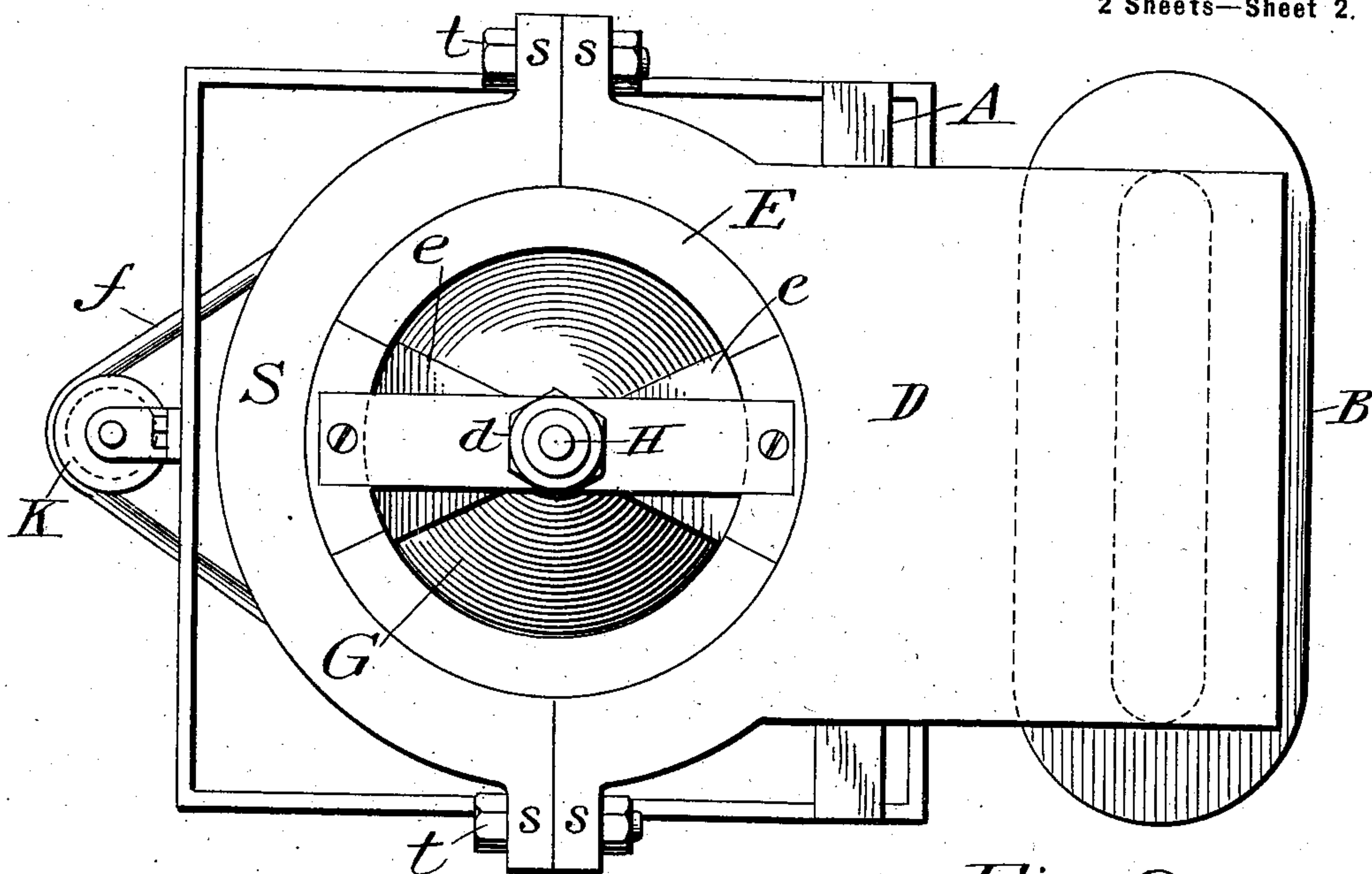


Fig. 2.

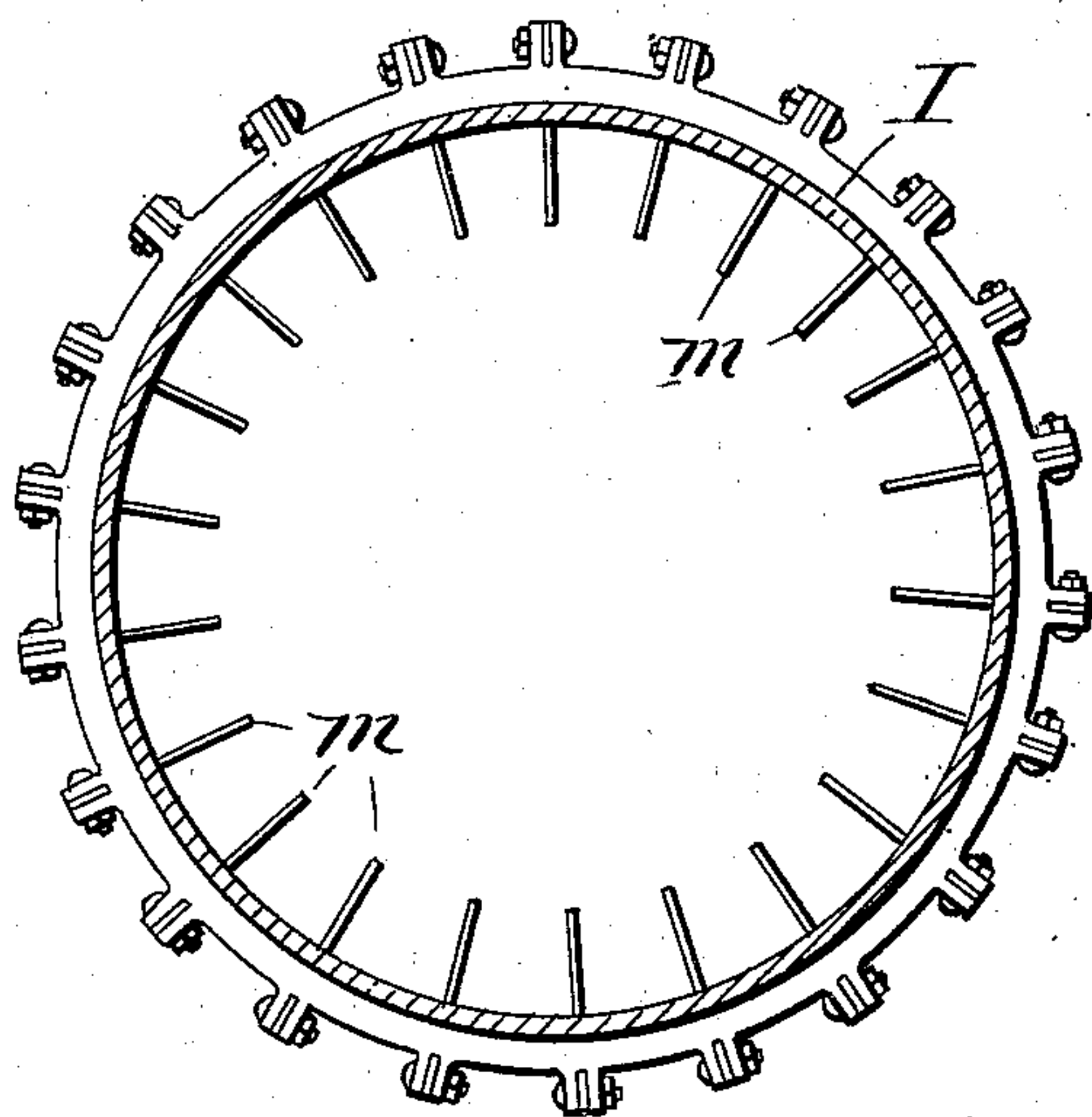


Fig. 3.

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UNITED STATES PATENT OFFICE.

JOHN PRICE WETHERILL, OF SOUTH BETHLEHEM, PENNSYLVANIA.

MAGNETIC SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 708,187, dated September 2, 1902.

Application filed August 26, 1901. Serial No. 73,299. (No model.)

To all whom it may concern:

Be it known that I, JOHN PRICE WETHERILL, a citizen of the United States, residing at South Bethlehem, county of Northampton, and State of Pennsylvania, have invented certain new and useful Improvements in Magnetic Separators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

In an application for Letters Patent of the United States filed of even date herewith, Serial No. 73,297, I have described and claimed, broadly, an apparatus for effecting the magnetic separation of fines and other ore mixtures containing magnetic and relatively non-magnetic or diamagnetic material by the expedient of feeding the material to be separated into the interpolar space or gap formed between two magnet-poles, washing out by the aid of water-jets the non-attracted material, and removing and separately collecting the material magnetically detained in the interpolar space by means of scraper-blades. My present invention consists in another form of apparatus operating upon the same general principle, but of different specific construction. In still another application, also filed of even date herewith, Serial No. 73,298, I have described and claimed another form of apparatus, likewise embodying the same general principle, but of different specific construction.

In the accompanying drawings, Figure 1 represents a vertical section of an apparatus embodying my present invention, a portion of the electromagnet being shown in elevation. Fig. 2 represents a top plan view of the apparatus. Fig. 3 represents a transverse section of the scraper mechanism on the line 3 3 of Fig. 1.

Similar letters of reference indicate similar parts throughout the several views.

Referring to the drawings, A indicates a vat or tank adapted to receive water, which is designed to maintain substantially the level indicated in Fig. 1. The coil B of the electromagnet is exterior to the vat or tank A, so as to be out of contact with the water therein. Its core is provided with flat extensions D D', each of which is expanded at its outer

end and is provided thereat with the segment S, of semicircular contour, so as to surround the cylindrical pole-pieces E E' of the magnet, which are clamped in place by means of the lugs s and clamping-bolts t, as shown more fully in Fig. 2. The opposing ends of the tubular pole-pieces are preferably pointed or wedge-shaped, as shown, so as to concentrate the lines of magnetic force across the interpolar space or gap between them, and at suitable intervals in their periphery the magnetic material composing them is cut away and the removed sections are replaced by like sections b b', of brass or other non-magnetic material, of the general configuration of triangular prisms having their broadest bases opposite each other, with the resultant effect of still further concentrating the lines of magnetic force across the interpolar spaces between the intervening sections of magnetic material.

Within the interior of the hollow pole-pieces is located a vertical shaft, whose lower portion F is square in cross-section and fits within a corresponding squared step g, so as to have a capacity for vertical adjustment within said step while being held against rotation. The shaft F carries the distributing-cone G and is screw-threaded at its upper portion H, so as to be capable of adjustment up and down by means of the nut d. The cone is provided with suitable cover-plates or wings e, arranged opposite the non-magnetic sections b, so as to restrict the feed of the material to those portions of the interpolar space or gap opposite the magnetic portions of the polar projections.

Within the interpolar space or gap is arranged a rotary scraper consisting of a series of scraper-blades m, of brass or other non-magnetic material. These blades may conveniently be hinged to a rotatory shell or band L, running in ball-bearings, as shown, and receiving a movement of rotation by means of a band or rope f, driven from the pulley K from any suitable source of power. Exterior to the scraper-blades m is arranged a circular pipe S', adapted to receive a supply of water under pressure from a supply-pipe T and having a series of jet-apertures, as shown, directed into the interpolar space or gap. At the bottom of the lower pole-piece

is located the receiving-hopper P for the non-attracted particles or tailings, and hoppers M N serve to receive the attracted magnetic particles or heads, as will hereinafter more fully appear. All of the hoppers are preferably provided with discharge-gates, as shown.

The operation of the apparatus is as follows: The material to be separated is supplied to the interior of the hollow magnet-pole E and is distributed by the cone G to the interpolar spaces between the magnetic portions of E E'. At the same time the rotary scraper is put in operation and water is supplied to the annular pipe S' and is directed in the form of jets into the mass of material as it enters the interpolar spaces. The magnetic particles are thereupon attracted and detained in the interpolar spaces, and the non-attracted particles entangled therein are washed out under the influence of the force of the jets and the dissolving action of the water and sink into the hopper P. The attracted particles detained in the interpolar spaces are carried along by the scrapers until they enter the spaces intervening between the non-magnetic sections *b b'*, whereupon, being removed from the fields of magnetic force, they are released, the major portion of them falling into hoppers N and those that have crept beyond the ridge of the pointed pole-pieces falling into the hopper M. It will of course be understood that the operation is designed to be a continuous one, the material to be separated being constantly supplied to the interior of the upper magnet-pole during the revolution of the scrapers and the continuance of the water-jets.

My invention is particularly applicable to the treatment of "fines," which are difficult of separation by ordinary forms of apparatus. It is not, however, restricted to this use, but may be employed for the separation of material of any suitable size or mesh.

Having thus fully described my invention, what I claim is—

1. A magnetic separator, comprising hollow tubular magnet-poles, separated by an interpolar space or gap traversed by the magnetic lines of force, a distributing-cone within the upper pole for directing the material to be separated into said gap, a water-jet pipe whose jet-orifices are directed into the gap, and a scraper operating in the gap; substantially as described.

2. A magnetic separator, comprising hollow tubular magnet-poles, separated by an interpolar space or gap traversed by the magnetic lines of force, a distributing-cone within the upper pole for directing the material to be separated into said gap, a water-jet pipe whose jet-orifices are directed into the gap, and a scraper operating in the gap, said scraper consisting of a series of scraper-blades mounted upon a rotatable carrier-ring; substantially as described.

3. A magnetic separator, comprising hollow

tubular magnet-poles, separated by an interpolar space or gap traversed by the magnetic lines of force, a distributing-cone within the upper pole for directing the material to be separated into said gap, a water-jet pipe whose jet-orifices are directed into the gap, and a scraper operating in the gap, said scraper consisting of a series of scraper-blades mounted upon a rotatable carrier-ring, said ring being carried by the upper tubular magnet and the scraper-blades being hinged thereto; substantially as described.

4. A magnetic separator, comprising hollow tubular magnets, separated by an interpolar space or gap traversed by the magnetic lines of force, said poles being provided with alternate magnetic and non-magnetic zones or sections along their peripheries, a distributing-cone within the upper pole for directing the material to be separated into the magnetic portions of the gap, a water-jet pipe exterior to the gap and whose jet-orifices are directed inwardly into the gap, and scraper-blades operating within the gap; substantially as described.

5. A magnetic separator, comprising hollow tubular magnets, separated by an interpolar space or gap traversed by the magnetic lines of force, said poles being provided with alternate magnetic and non-magnetic zones or sections along their peripheries, a distributing-cone within the upper pole for directing the material to be separated into the magnetic portions of the gap, a water-jet pipe exterior to the gap and whose jet-orifices are directed inwardly into the gap, scraper-blades operating within the gap, a receiving-hopper for tailings arranged below the hollow interior of the magnet, and receiving-hoppers for heads arranged opposite the non-magnetic sections of the poles; substantially as described.

6. A magnetic separator, comprising two hollow tubular magnet-poles, separated by an interpolar space or gap traversed by the magnetic lines of force, means for feeding the material to be separated to said gap from within the magnet, an outlying annular water-jet pipe having its jet-orifices directed inwardly into the gap, a scraper operating within the gap, and suitable receiving-hoppers for the heads and tailings; substantially as described.

7. A magnetic separator, provided with hollow tubular magnet-poles, separated by an interpolar space or gap traversed by the magnetic lines of force, the upper of said poles serving as a feed-hopper to the gap, said poles being clamped within laterally-projecting extensions of the magnet-core; substantially as described.

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

JOHN PRICE WETHERILL.

Witnesses:

CHAS. WETHERILL,
J. STACY BROWN.