No. 342,583. PATENTED JAN. 29, 1907.

C. J. REED.

MAGNETIC SEPARATOR.

APPLICATION FILED AUG. 15, 1902.

3 SHEETS—SHEET 1.

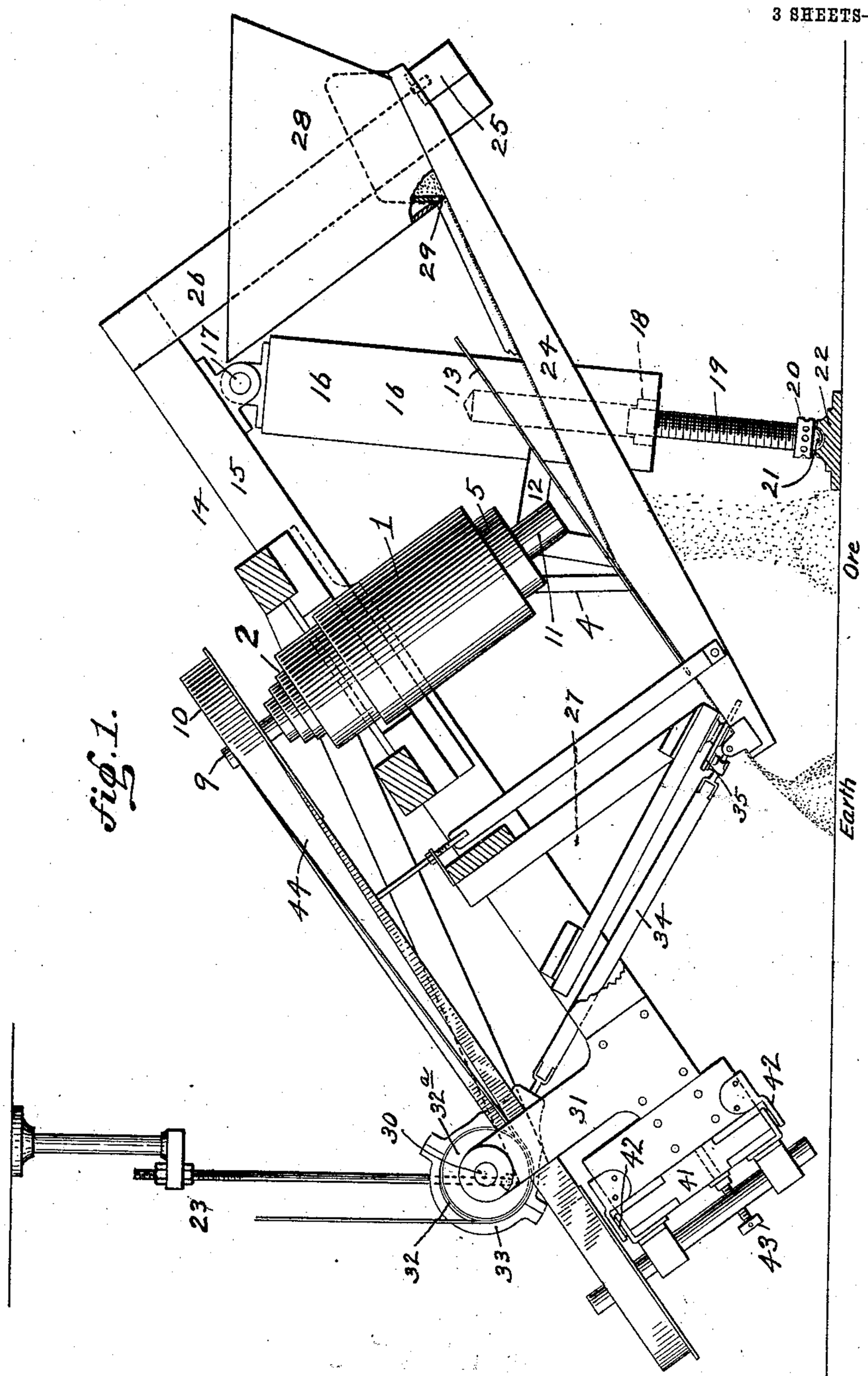


Fig. 1.

WITNESSES:

C. L. Belcher

J. C. Morse.

INVENTOR

Charles J. Reed

BY

Wesley & Coare

ATTORNEY.

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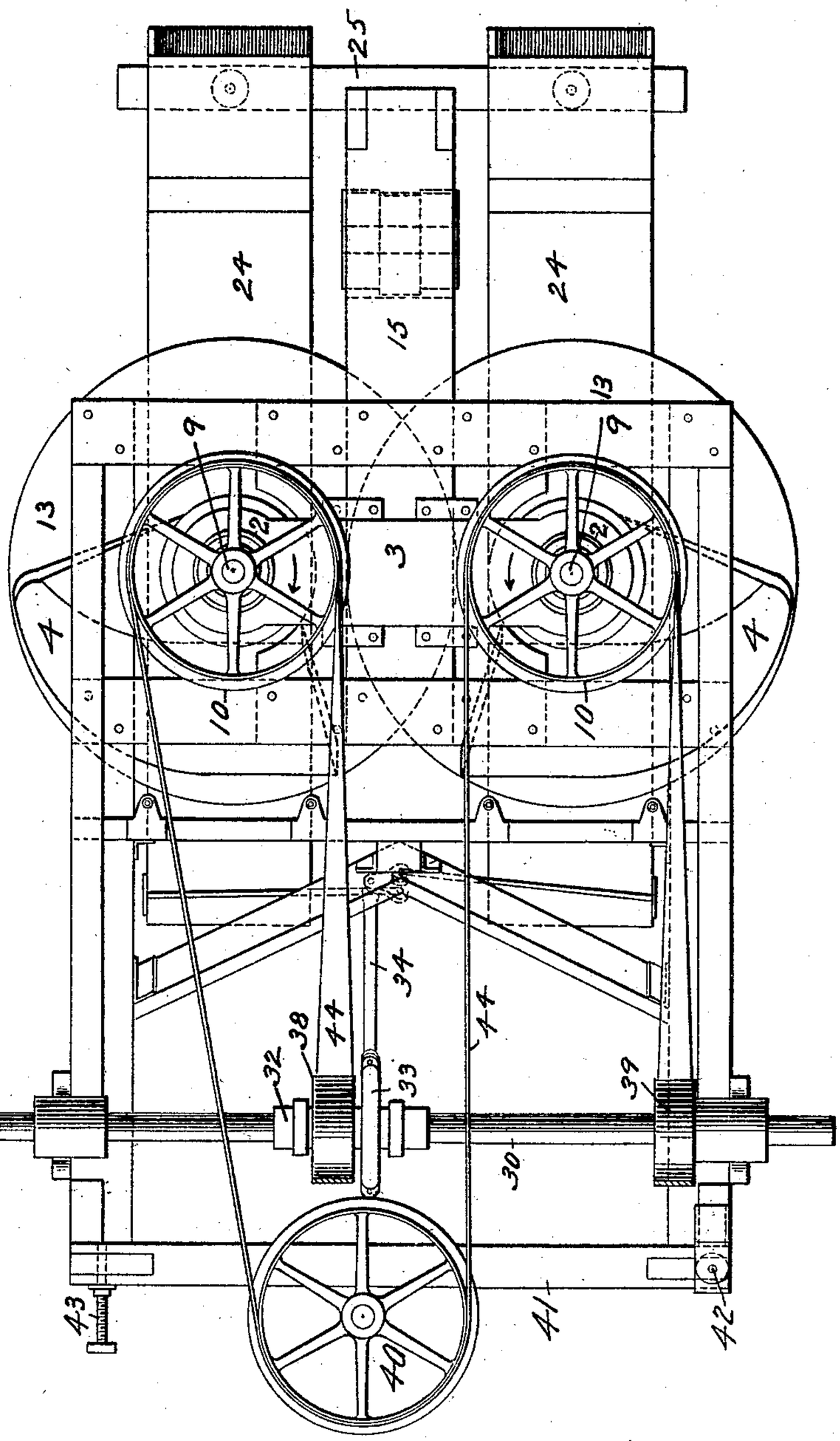
3 SHEETS—SHEET 2.

Fig. 2.




WITNESSES:

J. C. Morse.

Birney Hines

INVENTOR

Charles J. Reed

BY

Hosley & Sloan

ATTORNEY.

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C. J. REED.

MAGNETIC SEPARATOR.

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3 SHEETS—SHEET 3.

fig. 3.

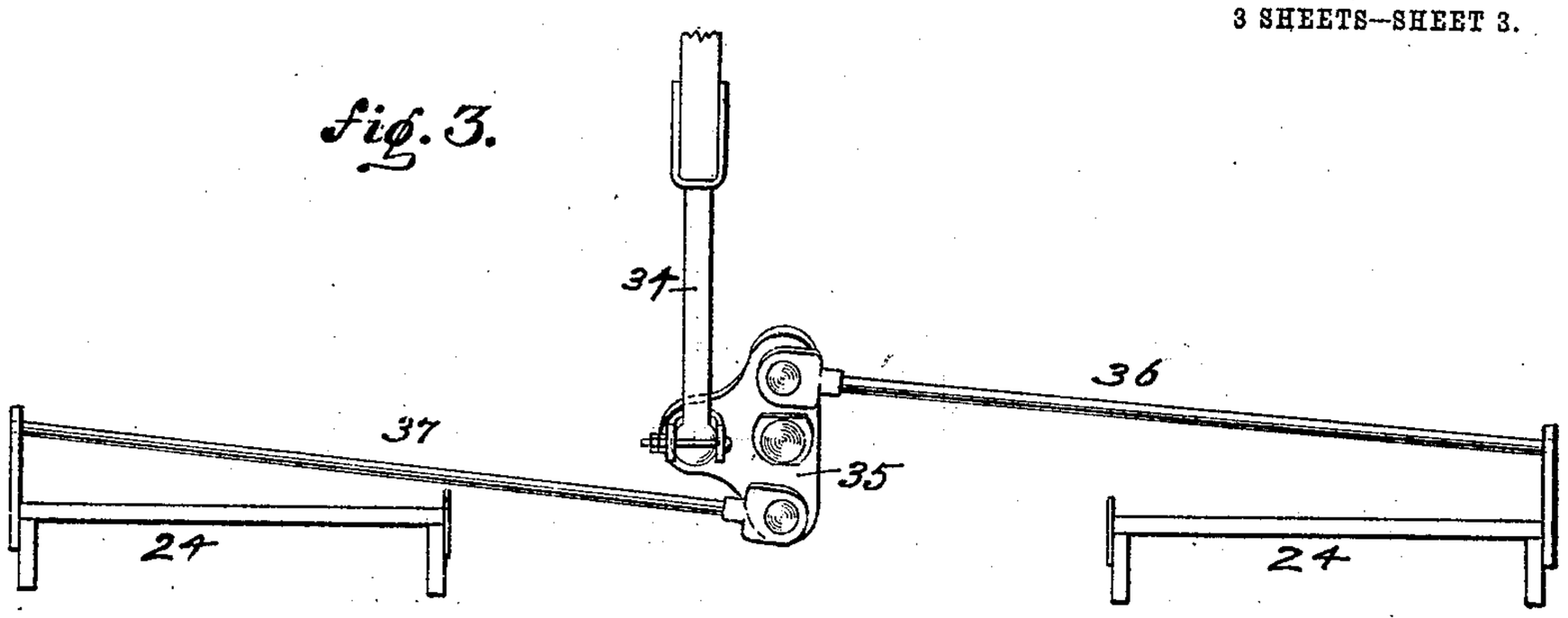



fig. 4.

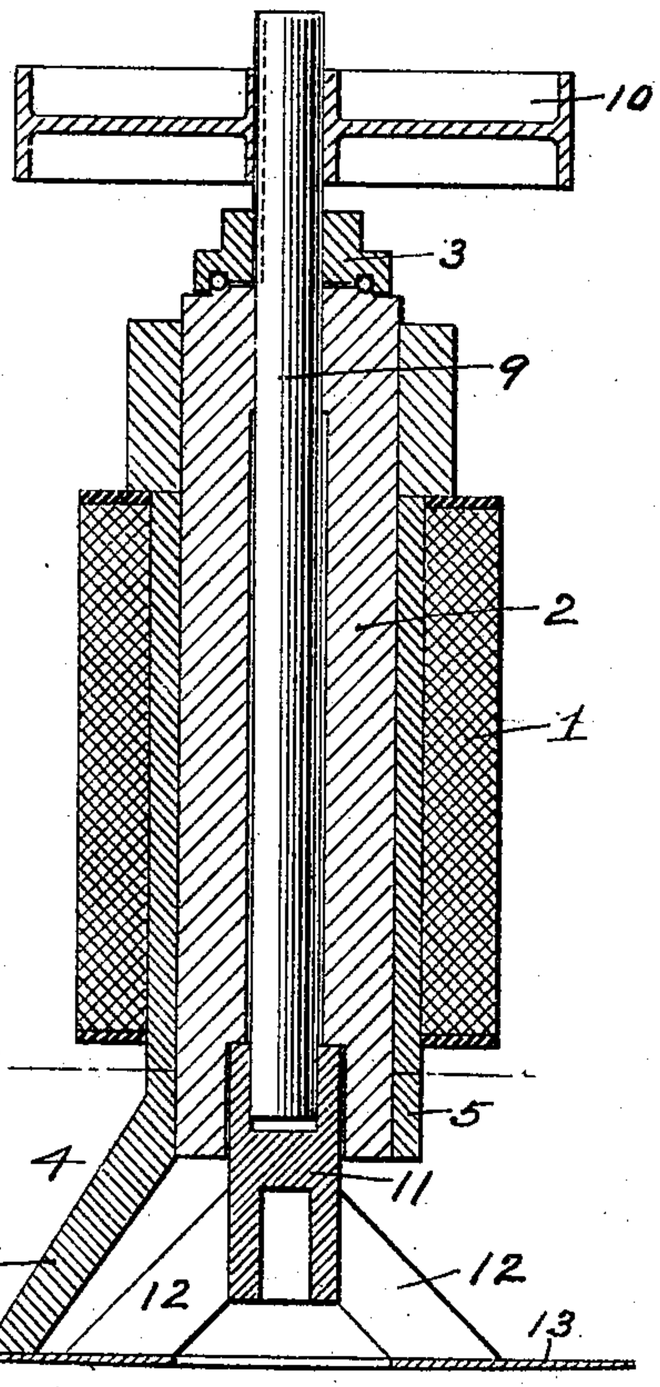



fig. 5.

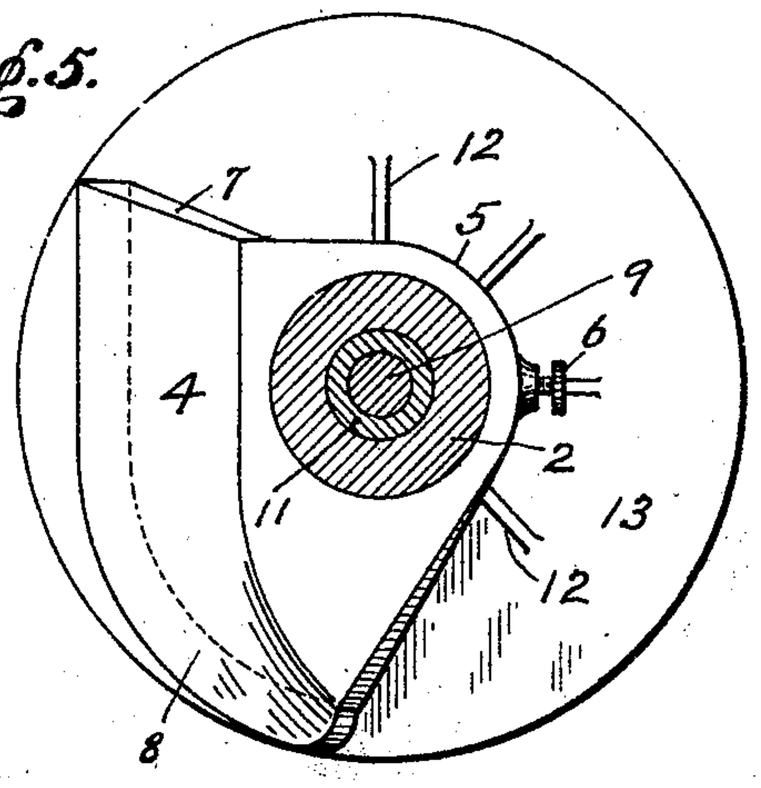
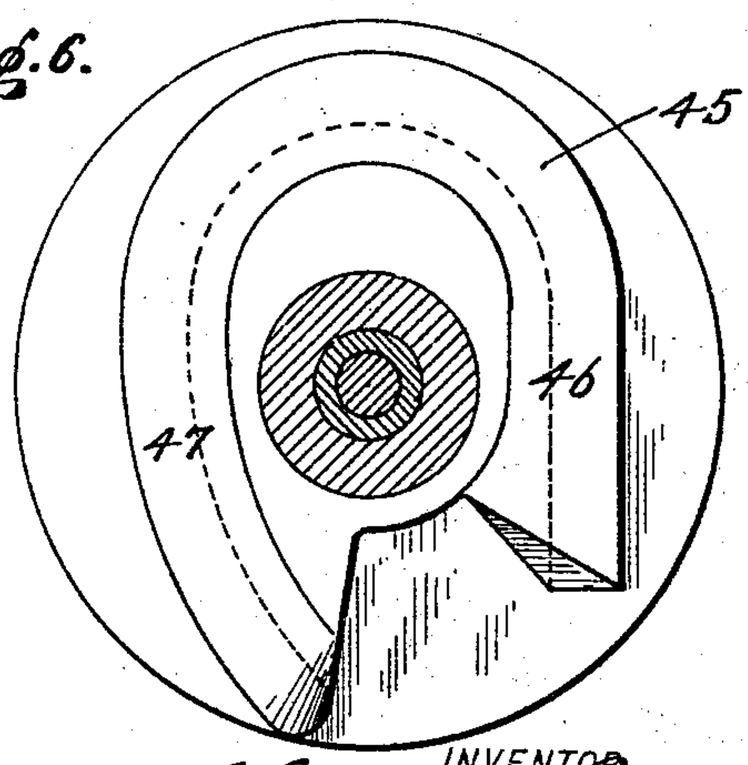



fig. 6.




WITNESSES:

J. C. Morse.

Birney Hines

INVENTOR

Charles J. Reed

BY

Keeley & Barr

ATTORNEY.

# UNITED STATES PATENT OFFICE.

CHARLES J. REED, OF PHILADELPHIA, PENNSYLVANIA.

## MAGNETIC SEPARATOR.

No. 842,583. Specification of Letters Patent. Patented Jan. 29, 1907.

Application filed August 15, 1902. Serial No. 119,763.

*To all whom it may concern:*

Be it known that I, CHARLES J. REED, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Improvement in Magnetic Separators, of which the following is a specification.

My invention relates to apparatus employed for separating magnetizable from non-magnetizable granular or comminuted material; and it has for its object to provide apparatus of this character which shall be simple and comparatively inexpensive in construction and which shall operate to effect the separation of concentrates from the comminuted ore more effectively and rapidly than can be done by the apparatus usually employed for this purpose.

Except as regards certain essential features of my invention the construction of the apparatus employed may be varied within wide limits; but I have devised apparatus which I have found satisfactory and effective in operation, and this I have illustrated in the accompanying drawings, in which—

Figure 1 is a view mainly in side elevation, but partially in section, of such apparatus. Fig. 2 is a view looking downward at right angles to the plane of the frame of the apparatus as shown in Fig. 1. Fig. 3 is a detail view of the device for effecting vibration of the ore-chutes. Fig. 4 is a longitudinal sectional view of one of the magnet-coils, its core, and the parts immediately connected to and coöperating therewith. Fig. 5 is a plan view of one of the separator-disks and the corresponding field-magnet pole-piece, the shaft for rotating the disk and the core of the magnet being shown in section. Fig. 6 is a view similar to Fig. 5, but showing a pole-piece of modified form.

As shown in the drawings, the separator-magnet comprises two coils 1, two corresponding cylindrical cores 2, a yoke 3, connecting the upper ends of the cores, and a pole-piece 4 for the other end of each of the cores.

As shown in Figs. 4 and 5, each pole-piece 4 comprises a collar 5, which fits over the core 2 and is fastened thereto by means of a set-screw 6 or other suitable means, and a piece 7, that projects outwardly and downwardly toward both sides of the apparatus. The end 8 of the pole-piece projects a greater distance than the other end and is preferably curved, as indicated, the curvature being eccentric to the core, for a purpose to be hereinafter more fully described.

Projecting through each cylindrical core and journaled and supported in suitable bearings is a shaft 9, the upper end of which is provided with a pulley 10 and to the lower end of which is suitably fastened a sleeve 11, from which project inclined arms or wings 12, to the lower ends of which is fastened an annular disk 13 of non-magnetic material. The arms 12, sleeve 11, and disk 13 may obviously be integral parts of a single structure, if desired. The sleeve 11 may be adjusted longitudinally on the shaft 9, but will be generally in such position that the top face of disk 13 will be in close proximity to the lower face of the pole-piece 4.

The frame 14, in which the parts already described are mounted, is built up mainly of longitudinal and transverse timbers, properly bolted together, and since such framework may be variously constructed as regards the number and location of its parts a specific description of the details of this portion of the apparatus is regarded as unnecessary.

The upper or main portion 15 of the framework is normally located at a considerable angle to the horizontal. As shown in the drawings, this angle is approximately thirty degrees; but in order that it may be varied to suit the desires of the user or any other conditions that may obtain I have provided an adjusting means comprising a bar 16, hinged at its upper end to the frame at 17 and having in its lower end a nut 18, with which engages a screw-rod 19, a longitudinal recess being provided in the bar 16 to receive this screw-rod. The lower end of the screw-rod is provided with a head 20, having holes for the insertion of a bar in order to turn it to effect the adjustment desired, and this head is provided with a rounded projection 21 on its lower side, which may rest upon any suitable support, a block 22, provided with a suitable recess at the top, being shown in the drawings.

The front of the frame may rest upon any suitable support on the ground or the floor of the building in which the apparatus is located, or it may be suspended from overhead floor joists or beams or roof beams or trusses by means of a suitable suspension device 23, as indicated in the drawings.

In order to feed the comminuted ore to the

apparatus for the separation of the magnetic particles therefrom, I provide one or more chutes 24, two being shown in the drawings, one end of each being supported upon a beam 25, which is in turn supported by timbers 26, that project downwardly from the upper portion 15 of the framework. Each chute is preferably pivotally supported upon the beam 25, so that it may vibrate laterally upon this support, and its front end is supported by means of adjustable hanger-rods 27.

The end of each chute which is supported upon the beam 25 may be provided with a suitable hopper 28, having an opening 29 at its front end, preferably extending the width of the chute, and the material may be shoveled into this hopper or may be supplied thereto by any suitable mechanically-operated conveying apparatus. The sides of the chutes should be of sufficient height above the bottom to retain the ore therein, and the bottom extends from the hopper at an angle to the disks 13 to the point corresponding to the position of the pole-pieces 4, and from that point to the other end the chute is substantially parallel to the disks and in close proximity thereto.

In order to effect vibration of the chutes to insure proper feeding of the material and also to agitate it to such an extent that the magnet will pick up all the magnetic material therefrom, I provide a shaft 30, which is supported in suitable standards 31, and on this shaft, which is, for convenience, held stationary, but which, of course, might be a rotating shaft, I mount a sleeve 32, and on this sleeve is fastened an eccentric $32^a$, the strap 33 of which is connected, by means of a rod 34, to a rocker-head 35, the latter being pivoted to a suitable part of the framework. One arm of the rocker-head is connected by a rod 36 to one of the chutes 24, and the other arm is connected by a rod 37 to the other chute 24, so that as the rocker-head is moved by the eccentric it will cause the chutes to vibrate laterally, and thus agitate and feed the material through them.

Mounted upon the sleeve 32 is a pulley 38, and journaled upon the shaft 30 near one side of the frame is a similar pulley 39. An idler-pulley 40 is journaled in suitable bearings in an auxiliary frame 41, that is hinged at 42 to one end of the main framework, and the other end of the frame 41 is provided with an adjusting-screw 43 in order that it may be adjusted laterally with reference to the main framework.

The vibrating apparatus and the separator-disks are operated by power from any suitable source—as, for instance, from the main shaft of an engine—either directly or indirectly through a line of shafting, (not shown,) by means of the pulleys already described and a belt 44, which passes from a pulley on the driving-shaft, (not shown,) beneath the pulley 39 on shaft 30, around the pulley 10 on one of the shafts 9, around the idler-pulley 40, around the other pulley 10, beneath the pulley 38, and thence to the pulley on the driving-shaft or from separate sources of power, the speed of either or both of which may be variable.

It will be seen from this construction that the disks 13 will be rotated in opposite directions; and if rotated in the directions indicated by the arrows in Fig. 2 the material as it is conveyed through the chute beneath the pole-pieces 4 will be separated, the magnets serving to pick up the magnetic particles and hold them to the disks until they are carried beyond the edges of the chutes and the extremities of the pole-pieces, when they will drop off, the non-magnetic particles being retained in the chute until they drop off at the end.

The curvature of the pole-pieces is made such that it does not coincide with the lines of force, so that as the disk rotates the magnetic field serves to tumble the material over and over, and thus remove all dust and other material which might otherwise be carried forward with the concentrates.

In order to more certainly separate all of the magnetic from the non-magnetic portions of the material, I may employ substantially the form of pole-piece indicated in Fig. 6, this pole-piece 45 being of approximately horseshoe shape, so that the part 46, beneath which the material is first fed, picks up the magnetic material, and if it does not take up all of it the portion 47 will be in position to remove the remainder as the material passes beneath it, the material being continuously agitated, so that the conditions are favorable for the removal of all of the magnetizable portion.

The pole-pieces obviously need not necessarily be of curved contour, and even though they be curved the curvature may be different from anything shown without departing from my invention. It will be further understood that the details of construction may be varied otherwise than as specifically set forth without departing from the invention.

I claim as my invention—

1. In a magnetic separator, the combination with a non-magnetic disk and means for rotating it, of an electromagnet having a curved segmental pole-piece the face of which is adjacent to the upper side of said disk and is eccentric thereto, an inclined chute for the material to be treated extending in proximity to the bottom face of said disk and means for effecting vibration of said chute to feed the material forward and insure presentation of all portions thereof to the action of the magnetic field.

2. In a magnetic separator, the combination with a non-magnetic disk and means for

rotating it, of an electromagnet having a curved pole-piece at one end the face of which is in proximity to said disk and is eccentric with reference thereto, an inclined chute extending beneath and adjacent to the rotating disk and means for causing the chute to vibrate laterally in order to feed the material forward and insure presentation of all portions thereof to the action of the magnetic field.

3. In a magnetic separator, the combination with an electromagnet having laterally-projecting pole-pieces, non-magnetic disks rotatably supported beneath and adjacent to said pole-pieces and means for rotating said disks in opposite directions, of a plurality of chutes extending beneath and in proximity to said disks and means for effecting lateral vibration of said chutes in order to feed the material forward and insure presentation of all portions thereof to the action of the magnetic field.

4. In a magnetic separator, the combination with an electromagnet having laterally-projecting pole-pieces and a plurality of non-magnetic disks rotatably mounted below and adjacent to said pole-pieces, of a plurality of inclined chutes extending beneath and in proximity to said disks and means for effecting vibration of said chutes in order to feed the material forward and insure presentation of all portions thereof to the action of the magnetic field.

5. In a magnetic separator, the combination with an electromagnet having laterally-projecting pole-pieces and a plurality of non-magnetic disks rotatably mounted below and adjacent to said pole-pieces, of a plurality of inclined chutes extending beneath and adjacent to said disks, means for effecting vibration of said chutes to feed the material forward and insure presentation of all portions thereof to the action of the magnetic field and means for varying the degree of inclination of said chutes.

6. In a magnetic separator, the combination with one or more rotatable, non-magnetic disks and means for rotating the same, of an electromagnet having laterally-projecting, curved pole-pieces the faces of which are adjacent to the upper side of said disk or disks and are eccentric thereto, one or more inclined chutes extending beneath and in proximity to said disk or disks and means for effecting vibration of said chute or chutes in order to feed the material forward and insure presentation of all portions thereof to the action of the magnetic field.

7. In a magnetic separator, the combination with one or more non-magnetic disks and means for rotating the same, of an electromagnet having laterally-projecting, curved pole-pieces, the curvature of which is eccentric to that of the disk or disks, one or more vertically-adjustable chutes extending beneath said disk or disks and means for effecting lateral vibration of the same in order to feed the material forward and insure presentation of all portions thereof to the action of the magnetic field.

In testimony whereof I have hereunto subscribed my name this 6th day of August, 1902.

CHARLES J. REED.

Witnesses:
JAMES W. LAWS,
ROBT. B. FLETCHER.