

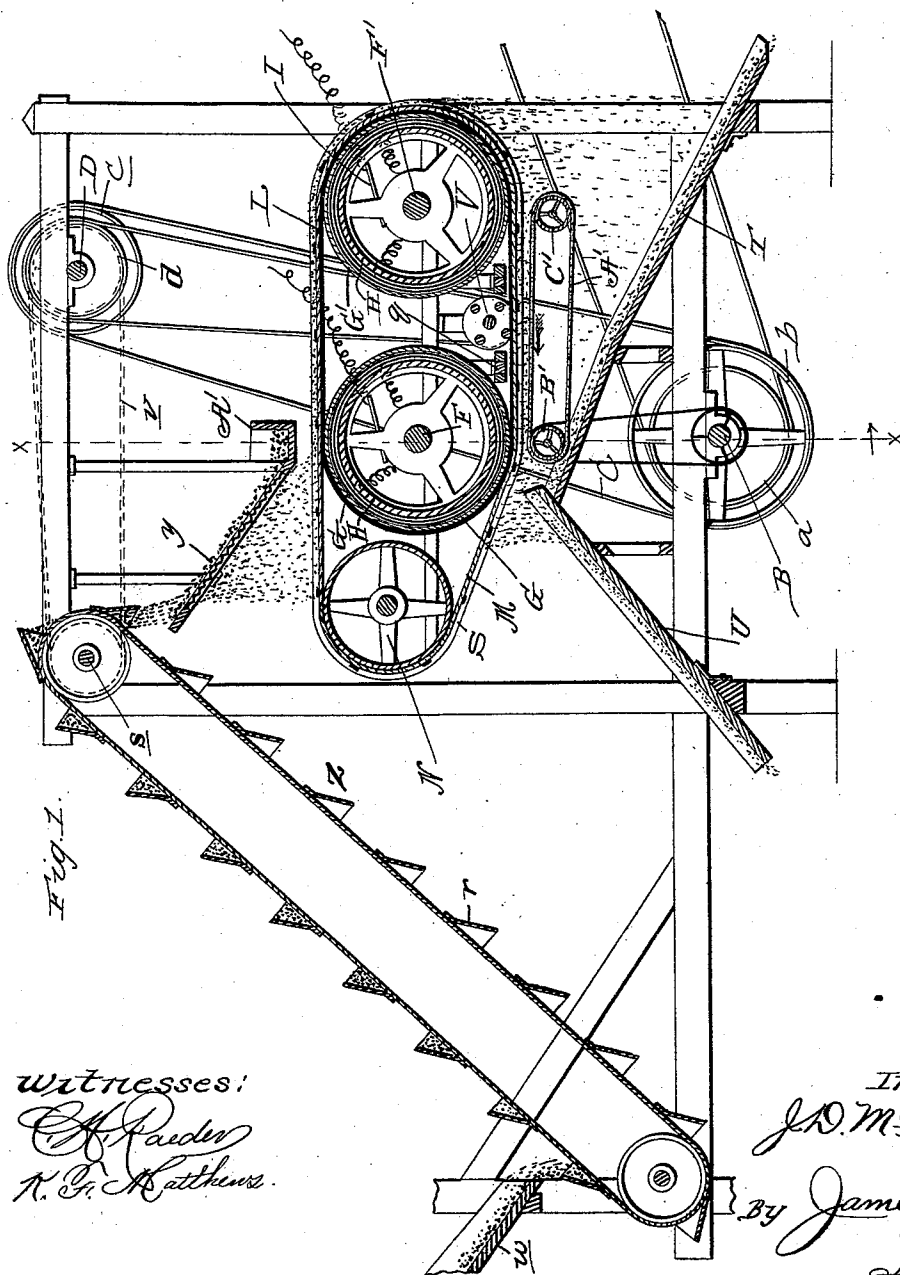
(No Model.)

2 Sheets—Sheet 1.

J. D. McKINNON.
MAGNETIC SEPARATOR.

No. 536,226.

Patented Mar. 26, 1895.



witnesses:

C. F. Rader
N. G. Matthews

Inventor
J. D. McKinnon
By *James J. Shuby*
Attorney

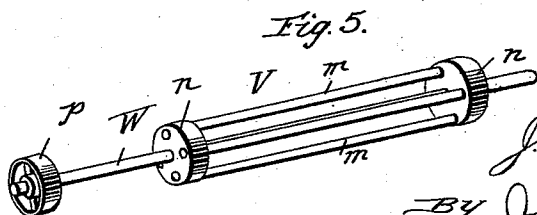
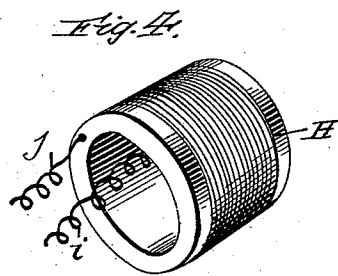
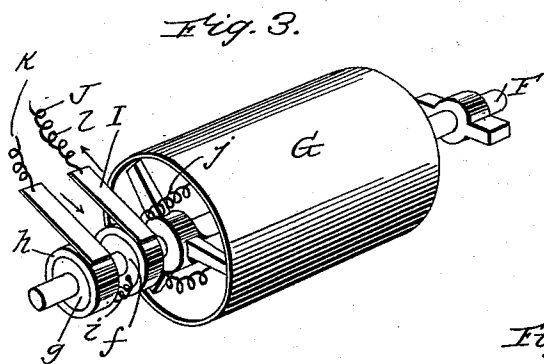
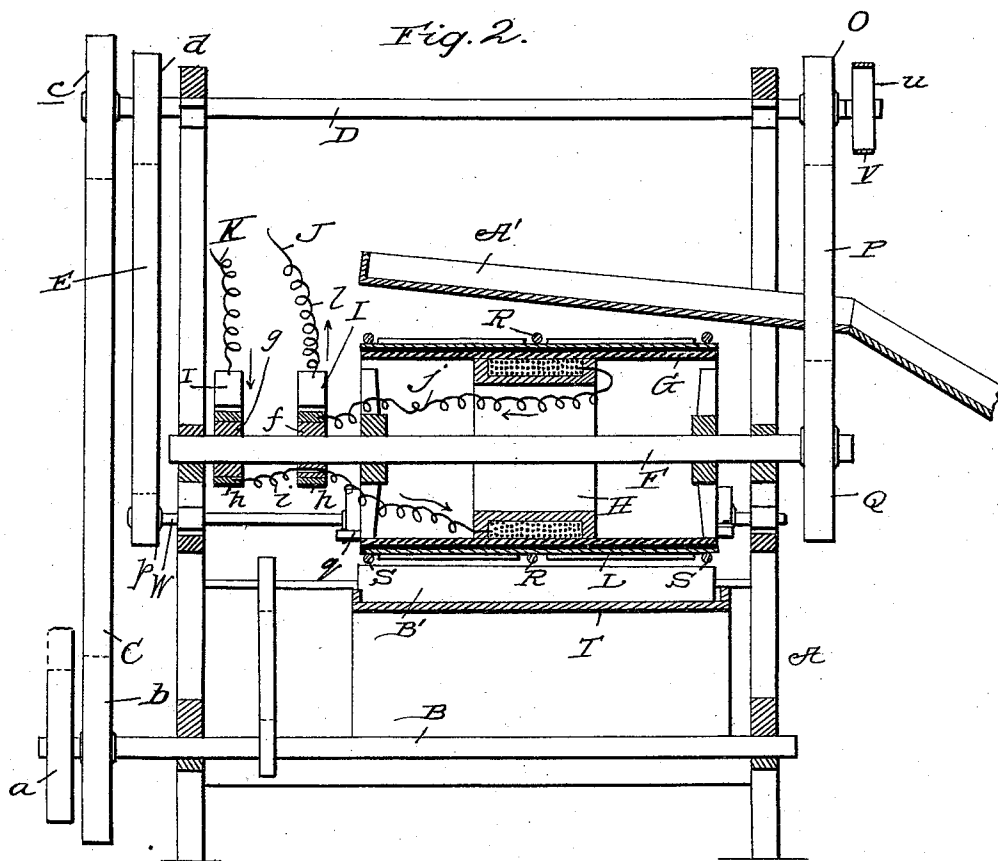
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UNITED STATES PATENT OFFICE.

JAMES D. MCKINNON, OF PORTLAND, OREGON.

MAGNETIC SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 536,226, dated March 26, 1895.

Application filed August 7, 1894. Serial No. 519,696. (No model.)

To all whom it may concern:

Be it known that I, JAMES D. MCKINNON, a citizen of the United States, residing at Portland, in the county of Multnomah and State of Oregon, have invented certain new and useful Improvements in Magnetic Separators; and I do 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.

This invention relates to an improvement in magnetic separators, and it has for its prime object to improve such machines by increasing the efficiency of the stratifying magnets, as well as the separating or final magnets, and to render more thorough the separation of magnetic from non-magnetic substances.

The invention and its many advantages will appear from the following description and claims when taken in connection with the annexed drawings, in which—

Figure 1, is a longitudinal, vertical, sectional view of my improved machine. Fig. 2, is a transverse, sectional view taken in the plane indicated by the dotted line *x, x*, on Fig. 1. Fig. 3, is a perspective view of one of the cylinders showing the brushes and the electrical connections. Fig. 4, is a perspective view of one of the bobbins removed from the cylinder with the terminal wires partly broken away. Fig. 5, is a perspective view of the agitator.

Referring by letter to said drawings:—A, indicates a frame, which may be of any suitable construction to sustain and support the various mechanical parts of the machine.

B, indicates a horizontal shaft which is suitably journaled in the lower portion of the supporting frame, and is provided with a pulley *a*, to receive a belt or the like to take motion from any suitable driving mechanism. Secured to this shaft B, is another pulley *b*, which receives an endless belt C, passing over a pulley *c*, fixed to an upper, horizontal shaft D. This upper, horizontal shaft D, which is suitably journaled in the frame, is provided near one end with a pulley *d*, over which passes an endless belt E, and which receives and converts motion to the shaft of the agitator, as will be presently described.

F, indicates a transversely-disposed, horizontal shaft, and F', indicates a similar shaft arranged parallel thereto and both shafts are supported at a suitable altitude in the main frame. These shafts carry cylinders G, G', and these cylinders are connected and supported upon the shafts by hubs and spokes, and are suitably insulated therefrom. Within each cylinder is placed a bobbin H, having suitably insulated electric wires and these bobbins are placed in contact with the internal surfaces of the cylinders so as to magnetize the latter. The shaft of each cylinder is provided with two collars *f*, and *g*, of non-conducting material, and these collars are surrounded by brass or other metallic bands *h*, to receive the current from the brushes I, carried from a suitable source of supply by means of the wires or conductors J and K. As the course of the current is the same for both cylinders, a description of one will be sufficient for a full understanding of the course of both. The current entering through the conductor K, as indicated by the arrow, will pass through the brush I, to the brass or metallic collar *h*, and from this collar, by means of the conductor *i*, will pass through the insulating collar *f*, to the coil on the bobbin. The current will then pass from the bobbin to the wires *j*, to the outer brass or metallic band *h*, around the inner collar of the shaft, and through the wire *l*, back to the source of supply. It will thus be seen that the cylinder will be thoroughly magnetized and the other cylinder will be magnetized in a similar manner. These cylinders are connected by a steel or other metallic belt or band L, and passing over this metallic belt or band L, is a canvas or non-magnetic belt M, which as well as passing over the cylinders, also passes over a wooden or other suitable pulley N. The shaft D, is provided near one end with a pulley O, and an endless belt or band P, passes from this pulley over a pulley Q, on one end of the shaft F', of the cylinder G, so as to impart motion thereto. When motion is imparted to the shaft of the cylinder G, such motion will be communicated to the cylinder G', through the medium of the endless metallic belt or band L, and motion will be simultaneously imparted to the canvas or other belt M, which is drawn tightly over the metallic belt.

In order to more effectively hold the canvas belt spread upon the metallic belt, and to also hold the central portion snugly down in contact therewith, I provide the canvas belt with
 5 a central cord or rope R, which may be sewed or otherwise secured to the canvas, and I also provide such belt on its upper side with marginal cords or ropes S, which latter serve the additional function of guards for the sand or
 10 material and prevent the same from falling off the belt during operation. Bamboo strips may also be placed on the surface of the canvas to keep it properly stretched laterally. By the provision of these cords, the magnetic
 15 force is increased by more firmly holding the belt in contact with the surfaces of the cylinders.

It will be observed that the wooden pulley N, is of a less diameter than the metallic cylinders and is arranged at a greater altitude.
 20 Below the magnetic belt and also the canvas belt covering the same, I provide an inclined chute T, for the white sand or non-magnetic material, and leading from the elevated end of this chute and inclined in an opposite direction is a chute or conveyer U, which receives and conducts the black sand or magnetic substance away. The intersection of these two chutes, is at a point where the
 30 outer belt or canvas leaves contact with the inner or metallic belt, and consequently the magnetic particles at this point becoming demagnetized, will fall into the chute U, while the white sand or non-magnetic substances
 35 will begin to leave the belt as it passes around the drum or cylinder G', there being nothing to retain it in contact. It has been found however that to render the separation perfect the material must be subjected to agitation, and this agitation aids very much in the stratification of the material so as to increase the magnetic attraction. For this purpose, I have designed and arranged an agitator in the field between the primary and secondary
 40 cylinders. In the illustration, I have shown this agitator as comprising a skeleton cylinder V, formed of a central shaft W, and four rods m, disposed relatively at right angles to each other and secured to heads n. The shaft of the
 45 agitator is provided with a pulley p, which receives the endless belt d, from a pulley on the shaft D, so as to impart a rotary motion to said agitator. The agitator is disposed transversely within the metallic belt or band L, so
 50 that the rods will successively strike said belt or band as it passes below the cylinders and keep it constantly vibrated during the operation of the machine, so that should there be any tendency for non-magnetic particles passing with the iron or other magnetic substance,
 60 it would be shaken off at this point, and discharged into the chute or conveyer T. Arranged on each side of the agitator and disposed transversely within the metallic belt are magnetized iron or steel bars, and these bars
 65 are kept magnetized by induction so as to

serve effectively in holding the belt under magnetic influence.

As the action of the agitator upon the belts L, and M, will cause some of the magnetic material to be shaken off during operation, I have
 70 interposed an endless belt between the chutes and said endless belts. This belt A', which is horizontally disposed may be composed of canvas or other suitable material and passes over
 75 two small drums B', and C', of non-magnetic material. These drums are secured on shafts which are suitably supported in the main frame and one of them may have a pulley to receive a suitable drive belt. These shafts,
 80 drums and belts are placed under the drums G, and G', slightly in advance of G', and extending well under G, so as to receive all the magnetic material shaken from the belts L, and M, by the action of the agitator and carry
 85 it under the drum G, where it will be taken up and deposited on the chute U. The non-magnetic material will fall from the belt A', down upon the chute T, and from there be
 90 carried off to a suitable point of discharge with such material as has fallen from the belts as they pass around the drum G'.

Z, indicates an elevator, which is shown as composed of an endless belt arranged upon an incline and carrying buckets r. This belt
 95 passes over a shaft s, suitably arranged in the upper part of the main frame, and carries a pulley which is connected with a pulley u, on the drive shaft D, by means of an endless belt v.

w, indicates a feed chute or trough for delivering the crushed or pulverized material to be separated into the elevating buckets, and
 100 y, indicates an inclined sieve arranged to receive from the elevator and disposed above the magnetized belt, and just above or slightly in advance of the primary cylinder. This sieve is designed to separate gravel, rocks, and the like from the pulverized ore, and such
 105 gravel is carried off by a laterally oblique chute or conveyer A'', which leads to a suitable point of discharge.

In operation it will be seen that as the sand or pulverized ore is carried up by the elevator and deposited on to the sieve, the fine particles passing through the sieve will be discharged upon the endless magnetized belt,
 110 while the gravel, and the like will be carried off by the chute or conveyer A''. Motion being imparted through the medium of the belt to the first or primary cylinder, as before described, will be communicated to the second cylinder by the metallic belt which will be held in the magnetic field, and by its magnetic force
 115 will hold upon the canvas belt such iron or other magnetic particles as may be deposited thereon. As the belt revolves the non-magnetic substances will fall from the belt and onto the chute T, while the magnetic particles
 120 although inverted and subjected to agitation will adhere to the belt until it reaches a point
 125 where the canvas belt leaves the magnetic or
 130

electric belt, and this point is where the chute U, intersects the chute T, so that the non-magnetic material will be deposited upon one chute and the magnetic substances upon another, and the separation will be complete and thorough by reason of the employment of the agitator which will knock off any white sand or non-magnetic material that might otherwise be held with the magnetic particles.

Having described my invention, what I claim is—

1. In a magnetic separator, an endless magnetized belt, magnets, and an agitator arranged in the magnetic field, substantially as specified.

2. In a magnetic separator, the combination with a plurality of magnetized cylinders, a metallic belt connecting the cylinders, a non-metallic belt arranged over the metallic belt, and an agitator for said belts, substantially as specified.

3. In a magnetic separator, a plurality of magnetized cylinders connected by an endless belt, a non metallic belt passing over the metallic belt, a pulley receiving the non metallic belt from the metallic belt, and a suitable means for delivering material to be separated, and a suitable means for receiving the separated material, substantially as specified.

4. A magnetic separator, comprising a suitable frame, two magnetic cylinders supported therein, an endless metallic belt connecting the cylinders, a pulley, a non-metallic belt passing over the metallic belt and also over the pulley, an agitator arranged in the magnetic field, a suitable means of feeding the material to be separated and two chutes disposed in opposite directions and meeting at a point where the belt becomes de-magnetized so as to receive the separated material, substantially as specified.

5. In a magnetic separator, the combination

with a plurality of magnetic cylinders, a metallic belt connecting the cylinders, a non-metallic belt passing over the metallic belt, an agitator arranged in the magnetic field, and a bar or bars of magnetized material arranged in the field so as to keep the belts under magnetic influence, substantially as specified.

6. In a magnetic separator, a plurality of magnetized cylinders, in combination with a metallic belt connecting the same, a non-metallic belt passing around the metallic belt, and an agitator arranged in the magnetic field, and comprising the skeleton frame composed of a central shaft, the heads thereon, and the rods connecting the heads, substantially as specified.

7. In a magnetic separator, the combination with a plurality of magnetized cylinders, a metallic belt connecting the cylinders, a non-metallic belt arranged over the metallic belt, an agitator arranged in the magnetic field, chutes to receive the non-metallic and metallic material respectively, and a movable endless non-metallic belt interposed between the magnetic belt and one of the chutes to receive metallic material shaken off by the agitator, substantially as specified.

8. In a magnetic separator, the combination with a movable and magnetized endless belt, an agitator for said belt arranged in the magnetic field, receivers for the separated material, and a non-magnetic endless belt interposed between the magnetized belt and the receivers, substantially as specified.

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

JAMES D. McKINNON.

Witnesses:

F. CLARNO,

ALEX. BERNSTEIN.