No. 858,734. PATENTED JULY 2, 1907.

# T. J. LOVETT.

## MAGNETIC SEPARATOR.

APPLICATION FILED OCT. 9, 1906.

2 SHEETS—SHEET 1.

Fig. 1.

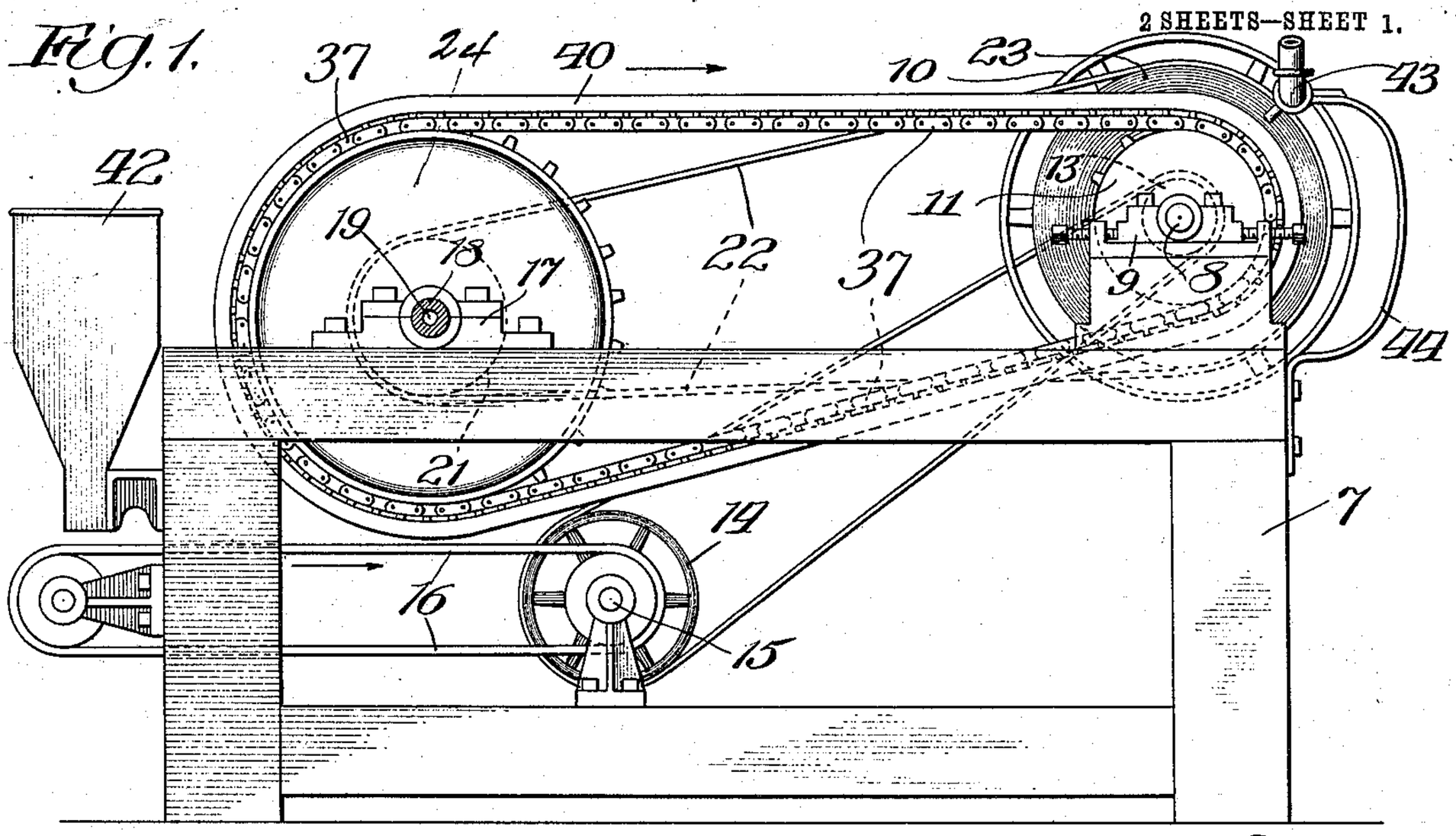
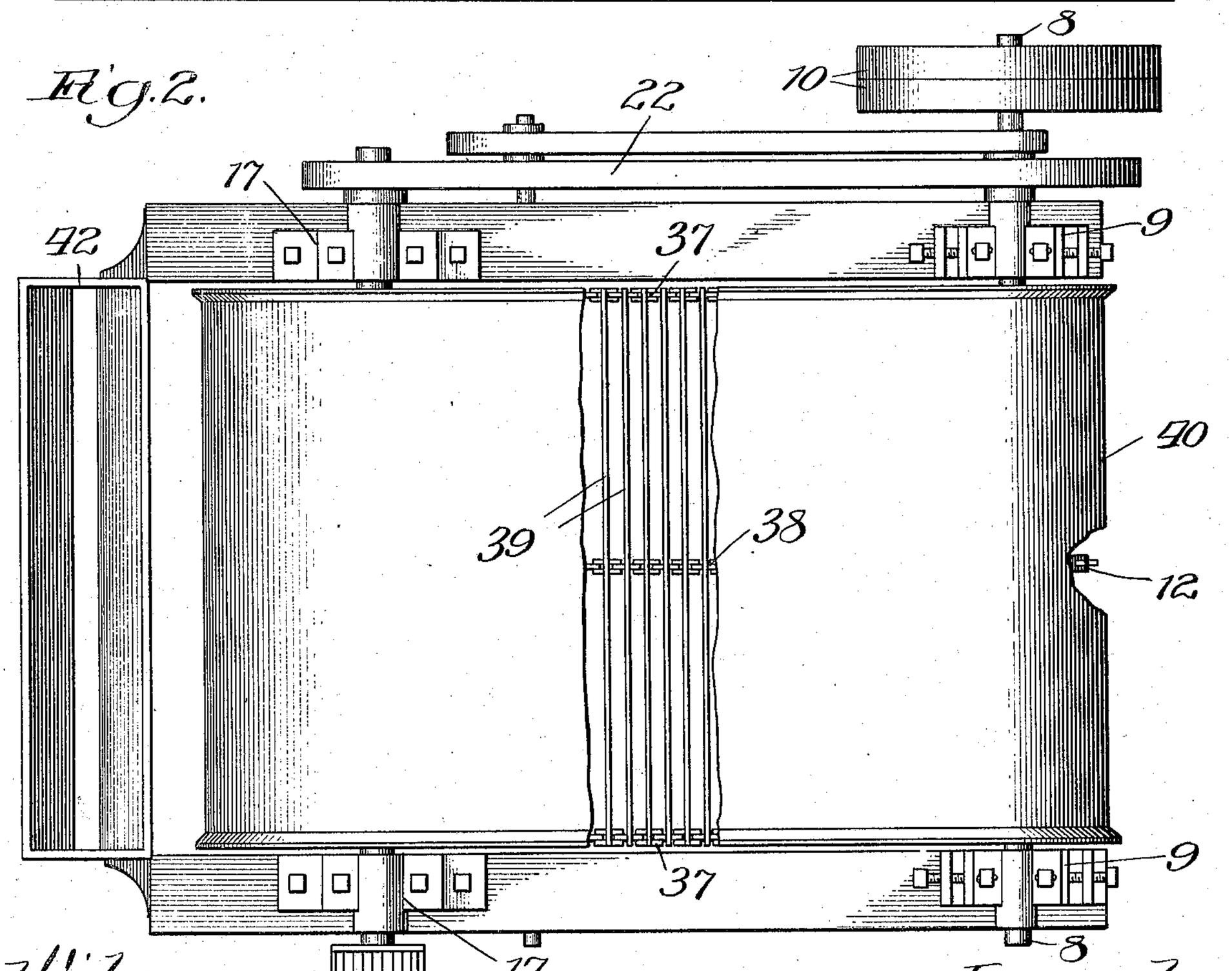



Fig. 2.

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2 SHEETS—SHEET 2.

Fig. 3.

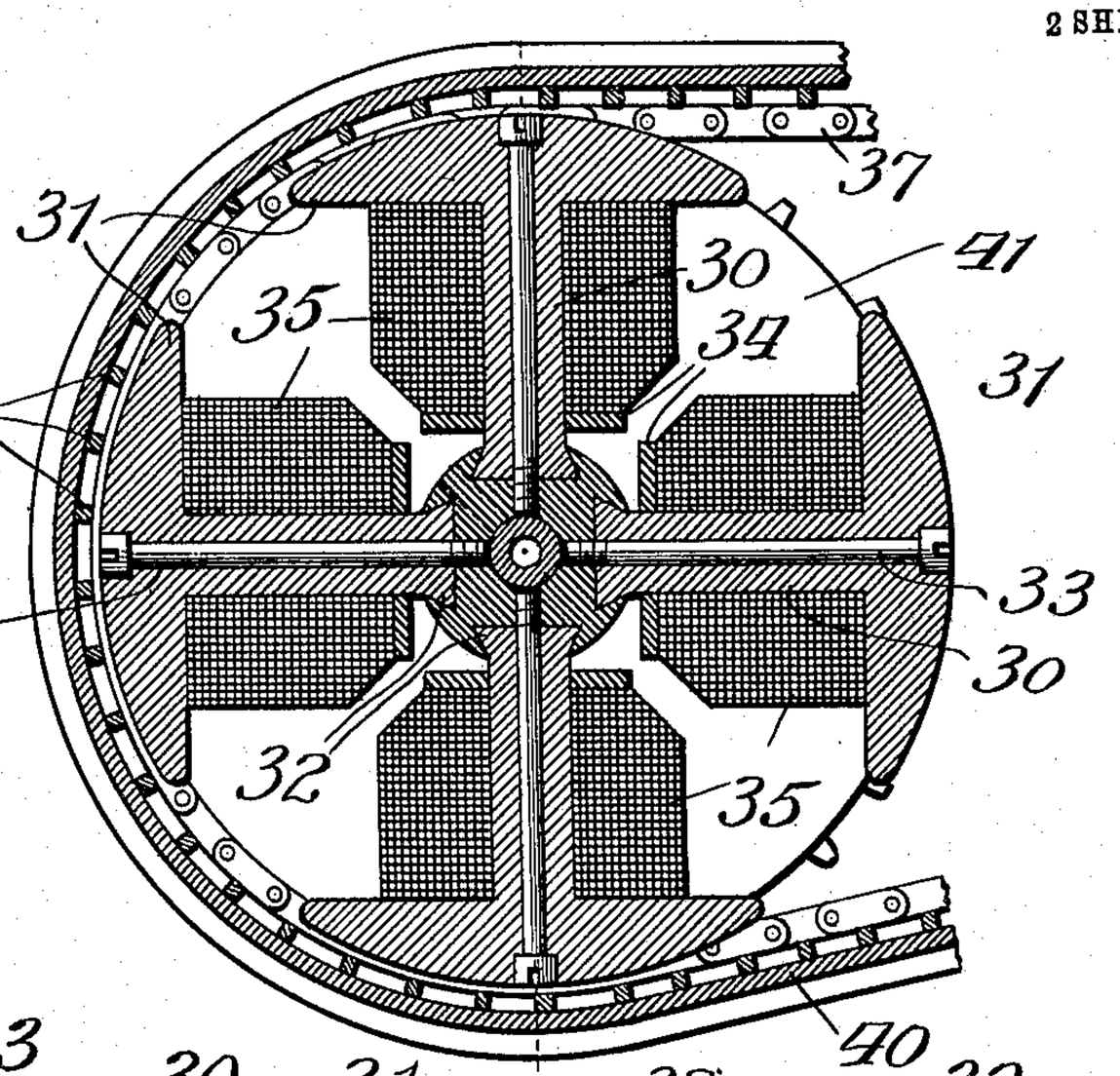


Fig. 4.

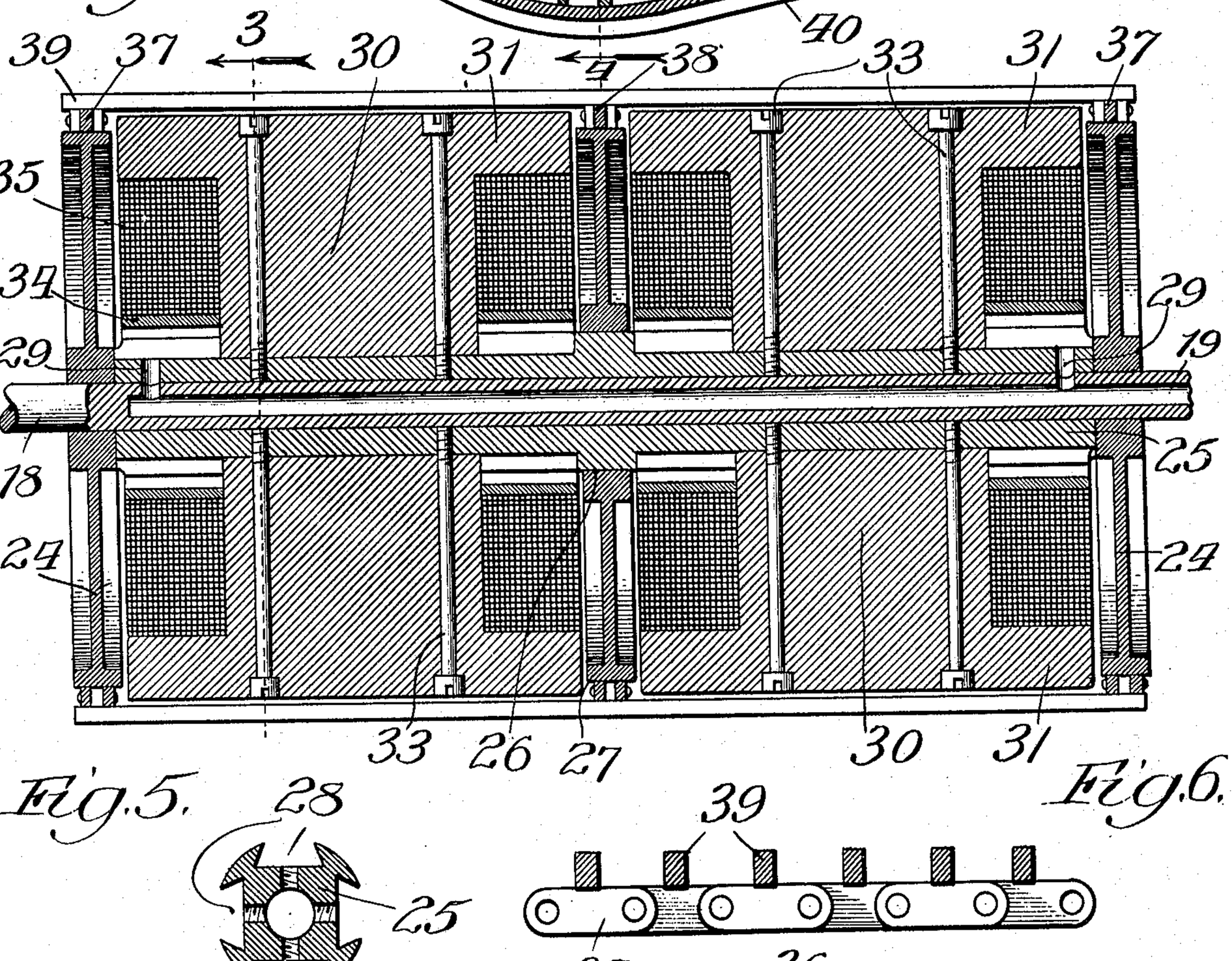


Fig. 5.




Fig. 6.




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# UNITED STATES PATENT OFFICE.

THOMAS J. LOVETT, OF CHICAGO, ILLINOIS.

## MAGNETIC SEPARATOR.

No. 858,734. Specification of Letters Patent. Patented July 2, 1907.

Application filed October 9, 1906. Serial No. 338,117.

*To all whom it may concern:*

Be it known that I, THOMAS J. LOVETT, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Magnetic Separators, of which the following is a specification.

My invention relates to improvement in electro-magnetic ore-separators of the type in which an endless belt, forming a conveyer for the magnetic concentrates, moves around a rapidly rotating cylindrical magnet, whereby finely divided ore conveyed across one side of the magnet is attracted thereby to the belt, turned over by changes in polarity, produced by the rotation of the magnet, and conveyed and discharged by the belt.

Hitherto it has been usual to employ as the armature, a Siemens magnet of the letter "H" type, and of a length approximating the width of the conveyer-belt. Thus, when a belt, say three feet wide, was used for conveying the concentrates, a magnet, or armature, approximating three feet in length was employed. It is a fact well known that in a magnet of the Siemens type the greatest magnetic force is at the end portions of the magnet and that greatly diminished magnetic force exists toward the center.

One of my objects is to provide a magnetic separator having an armature formed of a plurality of independently wound comparatively short magnet-sections placed side by side, longitudinally of the axis of rotation, and coupled either in series or in parallel, as desired, whereby the magnetic force is rendered substantially equal throughout the length of the sectional magnet.

It is also my object to construct the magnet-sections of a plurality of removable and replaceable independently wound members, coupled together in series, which will present comparatively large winding-spaces for the wire, make it possible to provide a comparatively large number of turns of the wire and provide a magnet which as a whole may possess much greater magnetic strength than any other magnet, of the same type and diameter, of which I am aware.

It is still further my object to provide improved belt supporting means, whereby the belt may pass closely around, without contact with, the cylindrical magnet and the structure of the latter is left, to a large degree, exposed to the cooling influence of the surrounding atmosphere.

In the accompanying drawings, I show a magnetic ore-separator of one desirable construction employing my improvements.

Referring to the drawings—Figure 1 is a side elevation of the separator provided with a feed-belt for use, more especially, where dry separation is to be performed; Fig. 2, a top plan view of the machine with a part of the concentrate conveyer-belt broken away to expose details of construction; Fig. 3, an enlarged broken sectional view of the magnet and conveyer belt taken on line 3 in Fig. 4; Fig. 4, a longitudinal section of the magnet taken on line 4 in Fig. 3; Fig. 5, a cross sectional view of a sleeve, or cylinder, provided with longitudinally extending dove-tail recesses to receive and hold the inner dove-tail ends of the core-shanks of the magnet members; and Fig. 6, an enlarged broken sectional view of a belt supporting drive-chain.

7 is a supporting frame on which is journaled a drive-shaft 8 mounted in adjustable bearing-boxes 9. The shaft 8 carries at one end a drive-pulley 10 and just within each bearing 9 a sprocket-wheel 11. Centrally between the said sprocket-wheels 11 is a similar sprocket-wheel 12. The shaft 8 also carries a pulley 13, which is belted to a puley 14 on a shaft 15 to drive a feed-belt 16 which may be disposed as shown in Fig. 1.

Mounted in bearings 17 on the frame is a shaft 18 hollow throughout most of its extent to form a wire-conducting passage 19 and carrying a commutator 20 at one end. At its opposite end the shaft 18 carries a small belt pulley 21 connected by means of a belt 22 with a drive-pulley 23 on the shaft 8. Loose upon the shaft 18 just within its bearings 17 are sprocket-wheels 24, and securely fastened to the shaft to form in effect an integral part thereof and extending between the hubs of the sprocket-wheels 24 in a sleeve, or cylinder, 25 provided at its center with an annular circumferential bearing face 26 for a central sprocket-wheel 27 of the same diameter as the sprocket-wheels 24, and rotating loosely upon the annular surface 26. Between the bearing portion 26 and sprocket-wheels 24 at opposite sides, the sleeve 25 is provided with, preferably, four longitudinally extending dove-tail sockets 28, and adjacent to the sprocket-wheels 24 are openings, or passages, 29 extending through the sleeve and shaft to the interior passage 19.

The magnet shown consists of two magnet-sections, each section being formed of four radially extending members. Each member comprises a wound core formed with a shank 30 and head, or shoe, 31. The shanks 30 have dove-tail inner ends 32 adapted to fit the dove-tail sockets 28. To prevent longitudinal sliding of the cores in the sockets 28, screws 33 are passed through the shanks, as shown, and screwed into threaded openings in the bases of the sockets 28. When in position, the outer surfaces of the heads, or shoes, 31 form a structure of substantially cylindrical form and describe arcs of a circle drawn from the center of rotation of the shaft 18. The diameter of each of these built up substantially cylindrical magnet-sections is slightly less than the diameter of the sprocket-wheels

24, 27. Each shank 30 carries an inner surrounding plate 34, whereby the core forms a spool of which the plate 34 and shoe 31 are the heads, and the shank 30 an oblong center. Each spool-section member is suitably wound with wire 35, and when the wound members are placed in position they are coupled together in series to form, in effect, a cylindrical magnet-section. The ends of the wire are passed through the openings 29 and through the passage 19 to the commutator 20. The two magnet-sections may also be coupled together in series, or they may be in parallel, as desired.

Running over the sprocket-wheels 24, 27 on the shaft 18, and over the sprocket-wheels 11, 12 on the shaft 8, is a preferably brass endless chain-belt device 36 consisting, preferably, of outer series of chain-links 37, 37 and an inner series of chain-links 38, the chains being joined together by parallel cross-bars 39, at their outer sides. The cross-bars 39 may be formed integral with the links, or fastened thereto in any suitable way. Stretched over the chain-belt 36 is a preferably flanged belt 40 which may be of rubber, canvas or the like.

In practice, the belts 36, 40 which drive the sprocket-wheels 24, 27 from the sprocket-wheels 11, 12, travel at one desired speed, while the shaft 18 and magnet is rotated at a materially greater speed by the belt 22. In the construction shown, the magnet rotates at approximately four times the speed of rotation of the sprocket-wheels 24, 27, and this speed may be diminished or even increased, if desired, depending, for example, on the character of material to be separated.

As is well known in the art, the positive attractive force of the substantially cylindrical magnet, is at the spaces 41, between the shoes 31 which form breaks in the circumferential surface of the core, and this attractive force is largely dependent upon the width of the said spaces, or, in other words, upon the areas of the shoes 31 relative to the circumference of the magnet. That is to say, if the edges of the shoes are brought closer together, the attracting power of the magnet at the spaces 41 is increased, and if the shoes are narrower, to increase the width of the spaces 41, the attracting power of the magnet at the spaces is decreased.

In practice, the belts would travel in the direction of the arrow, as shown in Fig. 1, and the magnet would rotate in the same direction at much higher speed. Ore delivered from the hopper 42 on to the belt 16 would be moved in the direction to pass beneath the magnet and be discharged from the belt 16 beyond the shaft 15. If the ore contains magnetic particles attractable by the magnet, they would be withdrawn from the mass upon the belt 16 to the surface of the belt 40, and carried thereby around to the upper side of the magnet and conveyed thence to be discharged beyond the shaft 8. While the particles are in the magnetic field the constant changes of polarity, produced by the rotation of the magnet, operate to turn them over and over to open them up and shake out any non-magnetic particles that may be incorporated with them as they move toward the top of the magnet.

The machine may be employed for wet separation if desired, and, in that case, to prevent the wet concentrates from sticking to the belt, they may be washed off by sprays from nozzles 43, indicated in Fig. 1 and mounted on supporting brackets 44.

In the construction shown, the magnet windings are freely exposed to the cooling influence of the atmosphere; and the function of the chain-belt 36 is to cause the belt 40 to move in close relation to, and out of contact with, the magnet. The bars 39 travel in a path as near as practical to the surface of the magnet, and the sprocket-wheel 27 operates to prevent the bars from sagging between their ends, under a heavy load, into contact with the magnet.

By forming the magnet of two, as shown, or a greater number of sections, the magnetic force is distributed more or less uniformly throughout the length of the magnet, transversely of the belt, which is a great advantage. By forming the magnet-sections of four members, the resultant changes in polarity occur very rapidly, and by rendering the members removable and replaceable and easy to get at as indicated, any repairs may be readily made when necessary. For example, should a short circuit occur in one of the section-members, the member may be removed and replaced with another section-member, or the core of the removed section-member may be quickly rewound.

It will be understood that the armature forms in effect a single pole-changing magnet, which in practice may be, say, three feet long by, say, ten inches in diameter. If the magnet were of a length, say, no greater than its diameter its strength midway between ends would be so nearly that at the ends, as to render the attractive force of its poles approximately uniform throughout; but when the magnet is of materially greater length and formed of a continuous wound core, it is so much weaker at the center than at the ends, as to interfere with its proper separating action, in many cases. By forming the armature of a plurality of sections, in endwise relation, in the manner described, its magnetic force may be rendered substantially uniform throughout, as is necessary for accomplishing the best results in operating upon many kinds of ore.

What I claim as new and desire to secure by Letters Patent:—

1. In a magnetic separator, the combination with a rotary electro-magnet and conveyer belt movable at different relative speeds, of supporting means for the conveyer belt comprising a chain belt underlying the conveyer belt, and chain belt engaging wheels rotating upon the same axis as the magnet and operating to maintain the chain belt close to but out of contact with the magnet.

2. In a magnetic separator, the combination of a rotary electro-magnet formed of a plurality of substantially cylindrical, independently wound, sections having a common axis of rotation upon which they are mounted in endwise relation, a conveyer belt, driving mechanism for the said magnet and belt operating to move them at different relative speeds, and supporting means for the conveyer belt comprising a chain belt underlying the conveyer belt, and chain belt engaging and supporting wheels journaled at opposite end portions of the magnet, to rotate upon the same axis as the magnet, and operating to maintain the chain belt close to but out of contact with the magnet.

THOMAS J. LOVETT.

In presence of—
W. B. DAVIES,
C. W. WASHBURNE.