No. 686,889. Patented Nov. 19, 1901.

H. M. DAGGETT.

MAGNETIC SEPARATOR.

(Application filed Aug. 7, 1899. Renewed Aug. 23, 1901.)

(No Model.) 3 Sheets—Sheet 1.

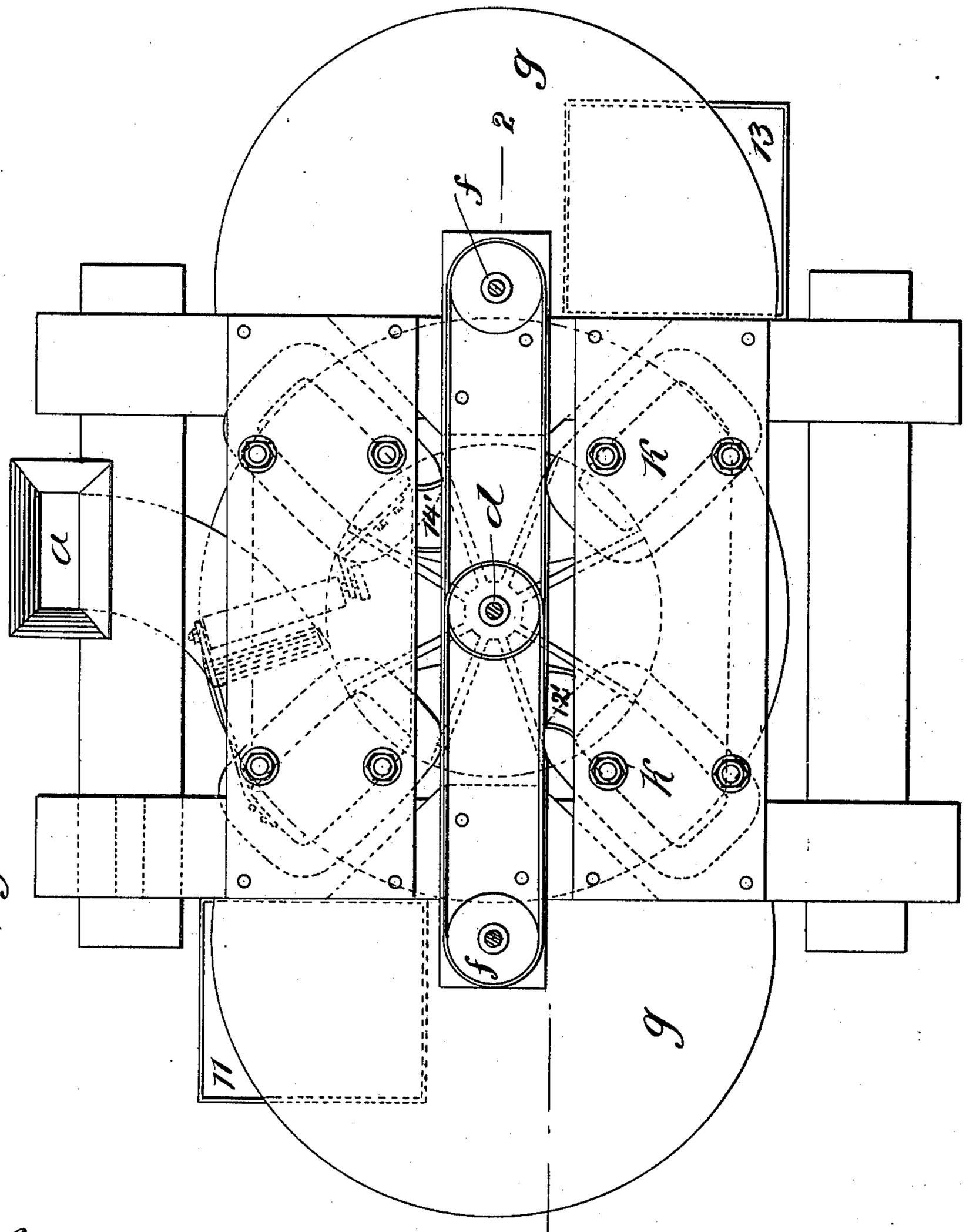

Fig. 1.

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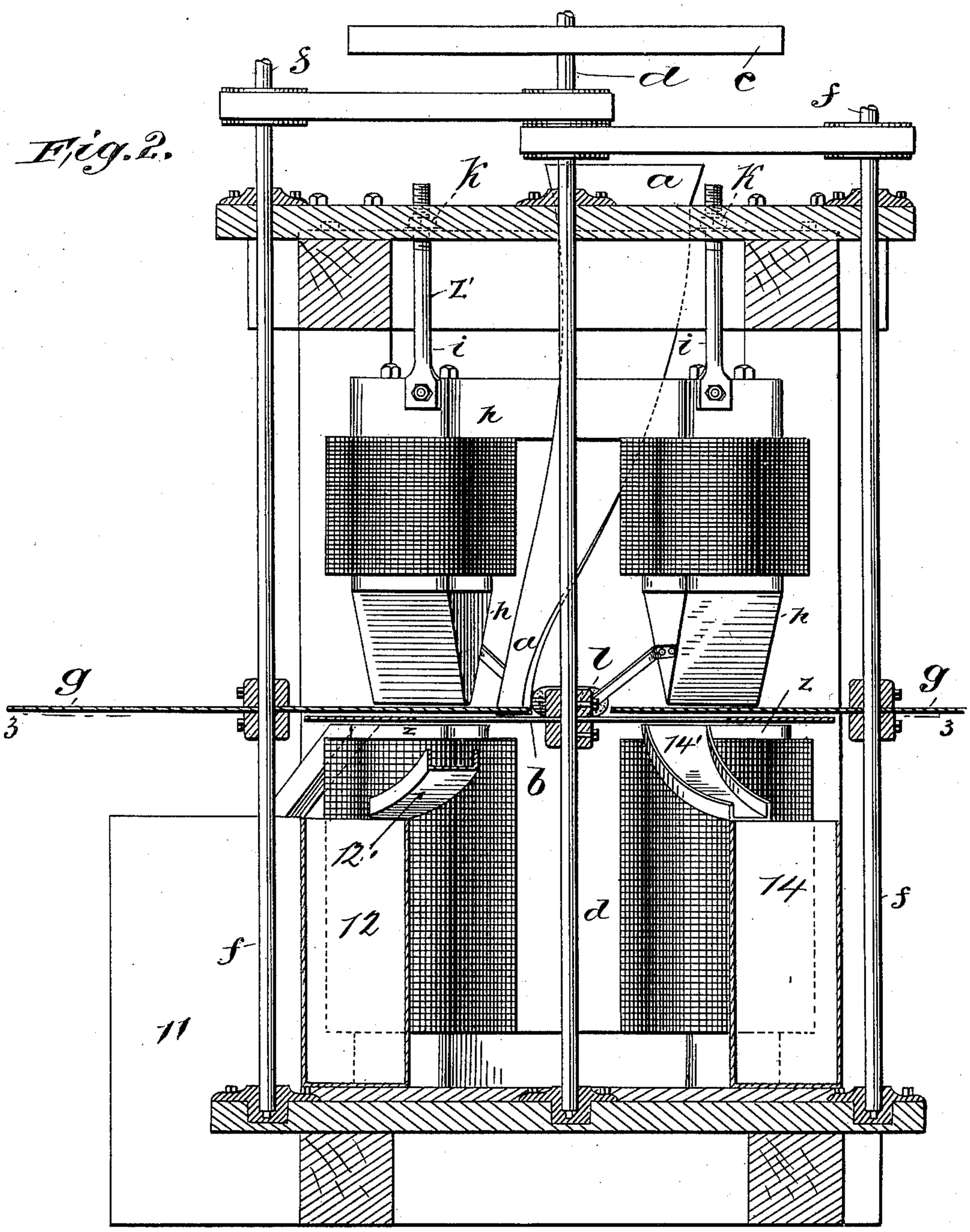
Fig. 2.



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(No Model.) 3 Sheets—Sheet 3.

Fig. 3.

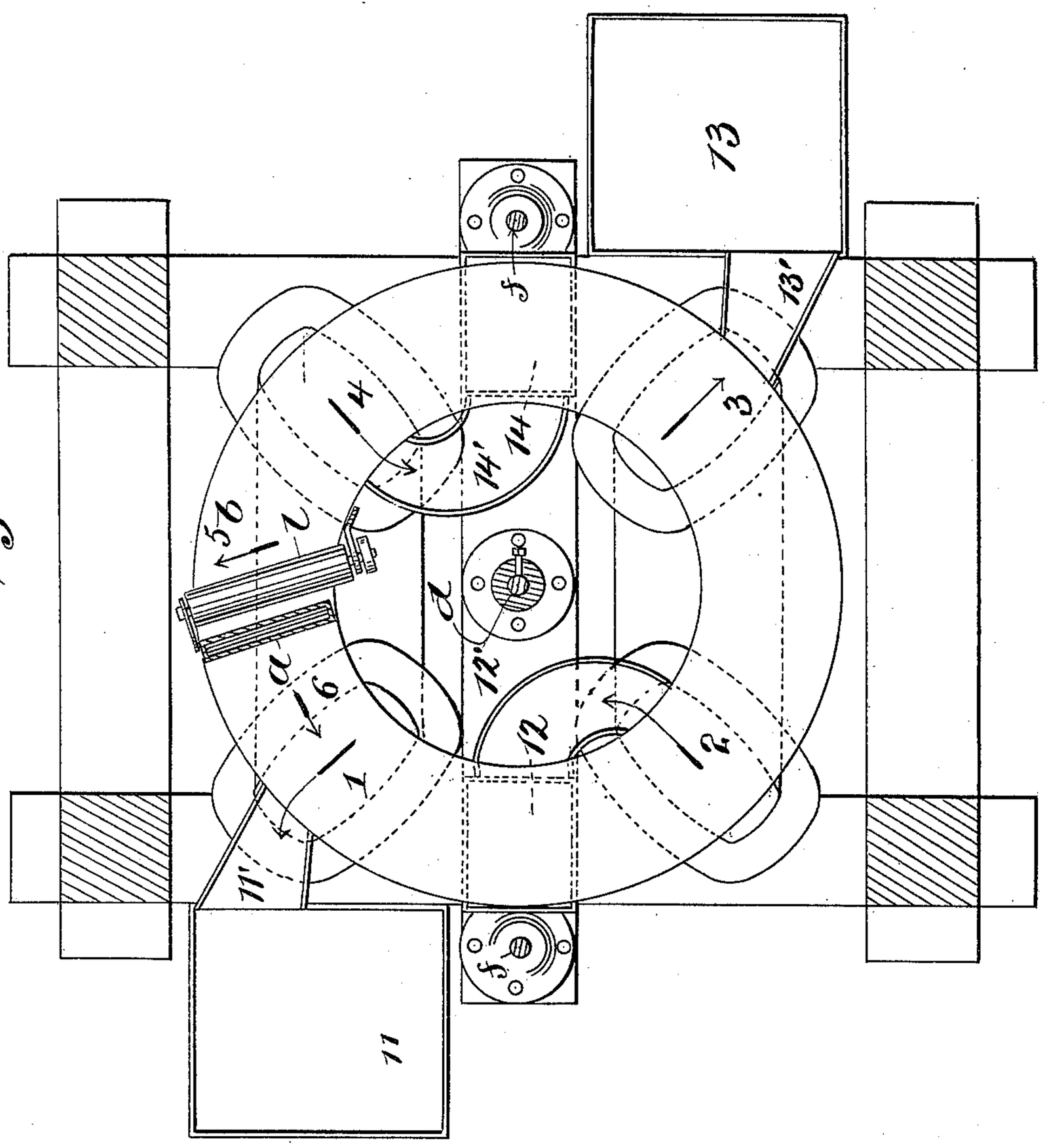
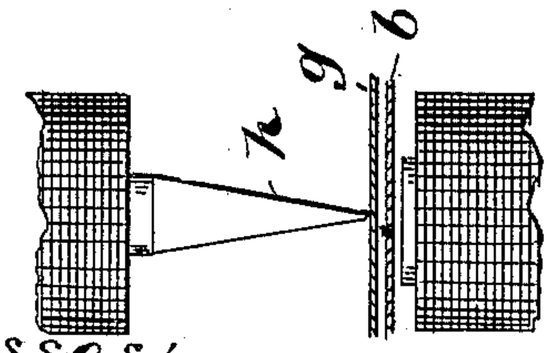


Fig. 4.



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MAGNETIC SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 686,889, dated November 19, 1901.

Application filed August 7, 1899. Renewed August 23, 1901. Serial No. 73,013. (No model.)

To all whom it may concern:

Be it known that I, HERBERT MYRON DAGGETT, of Philadelphia, Pennsylvania, have invented certain new and useful Improvements in Magnetic Separators, of which the following is a description, referring to the accompanying drawings, which form a part of this specification.

The invention is designed particularly for separating many so-called "magnetic" material or materials of very low magnetic permeability from sand or other less magnetic or diamagnetic materials. The invention, however, is not limited to such use. In principle the separator depends on a very short and concentrated magnetic field extending through a thin mechanical conveyer. The magnetic field instead of being nearly uniform throughout the air-gap between the poles decreases rapidly in density from a sharp edge forming one magnet-pole to a flat broad surface forming the other pole. The poorly but relatively more magnetic particles are drawn by the magnetism toward the sharp pole and up against the lower surface of the mechanical conveyer, and thereby carried out of the magnetic field and dropped into a suitable receptacle. Furthermore, owing to the arrangement of the apparatus and the suitable proportioning of several such magnetic fields, which act successively at different parts of the conveyer with progressively-increasing strength, I am able to separate materials into several different grades or constituents even when the different constituents vary but slightly in magnetic qualities.

The invention will best be understood from the accompanying drawings, which show one preferred form of it.

Figure 1 is a plan view of apparatus embodying my invention. Fig. 2 is a central vertical cross-section showing some parts, however, on the section-plane in full. Fig. 3 is a horizontal section on a plane between the disk *b* and disk *g*; and Fig. 4 is a detail of the pole-pieces, &c., as viewed radially of the disk *b*.

Throughout the drawings like characters of reference indicate like parts.

The material to be separated is supplied through chute *a* and delivered onto a revolving flat annulus or disk with open center *b*, carried by spider *c* on vertical shaft *d*, driven by pulley *e*. At the sides of the apparatus are two other shafts *f*, driven by belts from shaft *d*, as shown, and carrying each a flat disk *g*, which overlaps and lies very closely above the disk *b*, so that in rotating each point in a disk *g* will pass nearly at right angles across the annulus twice in each revolution while directly within the intense fields of the magnets H *z*. Directly above and in close proximity to the intersection of disk *b* with disks *g* are placed powerful electromagnets *h*, which are supported and adjustable vertically by means of rods *i* and nuts *k*. In the drawings the distances between the disks *b* and *g* and between the poles of the magnets *h* and disks *g* are exaggerated, so as to show the parts clearly. The peculiar shape of the upper pole-pieces, which are cut down to narrow edges and which are intended to be placed as near as possible to the disks *g* without touching them, results in producing a very intense magnetic field through the disks from these sharp edges to the lower set of magnets *z*, which have broad flat polar faces, as shown. By this novel arrangement the greatest possible change in magnetic intensity is produced from the sharp edges above to the broad polar surface beneath, and therefore the maximum attractive force toward the sharp poles results.

At *l* is a small rotary brush, turned by the pulley in a direction reverse to the movement of the disk *b* and functioned to sweep the remaining non-magnetic material off the disk *b* in the direction shown by the arrow 5 in Fig. 3.

The operation of the apparatus is as follows: The material is delivered onto the moving surface of the disk *b* through the chute *a* and carried in the direction indicated by arrow 6, Fig. 3, beneath one of the disks *g*. If the magnets which act through the disk *b* at this point are sufficiently strong and if the material to be separated is in part appreciably magnetic, all such magnetic material will be drawn up against the lower face of the disk *g* and carried off by the disk, as shown by the arrow 1 in Fig. 3, until leaving the magnetic field the magnetized material, losing its attraction, falls into the chute 11′, leading to the receptacle 11. A similar action takes

place beneath each of the successive magnets, the attracted material being carried off in the direction shown by the arrows 2, 3, and 4 falling into respective receptacles 12, 13, and 14. If the first magnets to act upon the material be the weakest and the strength of the successive magnets be increased, each of the magnets will attract and separate a portion of the relatively more magnetic substances, leaving the relatively less or diamagnetic substances to be swept off of the disk *b* by the brush *l*. It will be seen that the disk *b* carries the relatively less magnetic or diamagnetic material from the chute *a* to the brush *l* and that four successive times the several materials are subjected to the magnetic separation and the attracted particles separated and carried off, first toward the outer edge and then toward the inside of the annular disk *b*, alternately, as shown by the arrows 1 2 3 4.

By the term "disk" I mean to include an open-centered disk or annulus.

The current supplied to the several magnets should be regulated to make each pair of magnets raise and separate the desired proportion of the material passing between them. It is, moreover, possible to use the apparatus in several ways. For instance, instead of making the first magnets the weakest and the last the strongest two pairs may be made stronger than the other two, or all four may be of equal strength, in which last case the successive magnets will merely supplement the work of the first.

I claim as the novel and distinguishing features of my invention the following:

1. In a magnetic separator, a frame supporting three parallel shafts, means for rotating the shafts, a disk or annulus carried by one of the shafts, two disks or annuluses carried by the other said shafts and overlapping the first said disk or annulus, and a plurality of electromagnets, having poles provided with sharp edges, which edges lie closely above the overlapping portions of the said overlapping disks or annuluses, and in lines tangential to the lines of movement of the disk or annulus immediately under them, substantially as set forth.

2. In a magnetic separator for weakly-magnetic materials, an annulus or open-centered disk, means for rotating it, a second disk overlapped above the first said annulus or open-centered disk, so as to extend over the open center thereof, means for rotating it, and a plurality of magnets acting through the overlapped portions of the upper annulus or disk at points where it is moving toward the open center and also at other points where it is moving from the open center of the first said annulus or open-centered disk, substantially, as set forth.

3. In a magnetic separator for weakly-magnetic materials, an annulus or open-centered disk, means for rotating it, a second disk overlapped above the first said annulus or open-centered disk, so as to extend over the open center thereof, means for rotating it, and a plurality of magnets acting through the overlapped portions of the upper annulus or disk at points where it is moving toward the open center and also at points where it is moving from the open center of the first said annulus or open-centered disk, the said magnets being successively stronger in effect counting from the point of feed, substantially as set forth.

4. In a magnetic separator for weakly-magnetic materials, the combination with a mechanical conveyer and a superposed cross-conveyer, of a magnetic system having a sharp pole presented above the conveyers and a broad pole beneath the conveyers whereby the magnetic field increases in strength upward and is substantially vertical, substantially as set forth.

5. In the magnetic system of a magnetic separator, and in combination with means for carrying the material to the magnetic field, an opposed pair of relatively sharp or narrow and blunt or broad magnetic poles placed to form a vertical magnetic field which increases rapidly in strength upward and acts substantially vertically, substantially as set forth.

Signed this 27th day of July, 1899, at Philadelphia, Pennsylvania.

HERBERT MYRON DAGGETT.

Witnesses:

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T. B. RANKIN.