Nov. 18, 1924 1,515,719

J. P. BETHKE ET AL

MAGNETIC PULLEY

Filed Nov. 26, 1920

Fig. 1.

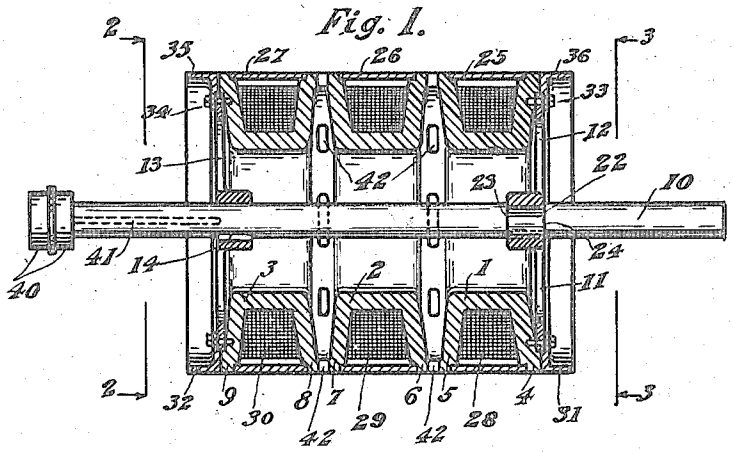


Fig. 2.

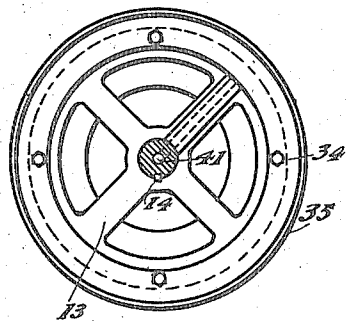


Fig. 3.

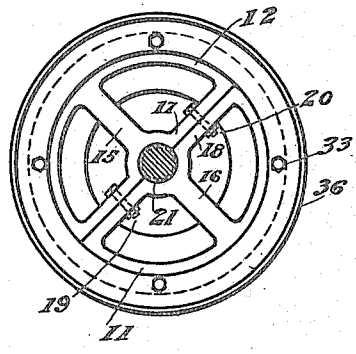
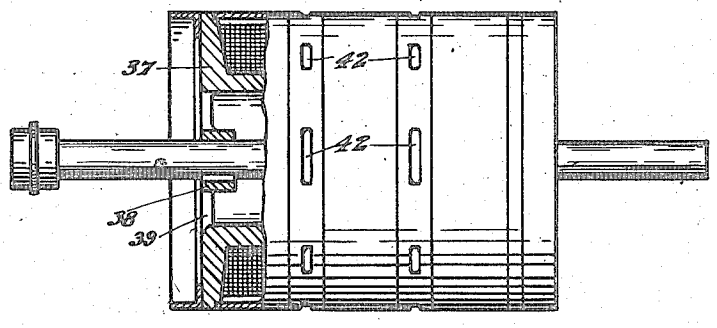


Fig. 4.



Inventor

John P. Bethke

George H. Fabian

By Erwin Mueller & Woolar.

Attorneys

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UNITED STATES PATENT OFFICE.

JOHN P. BETHKE AND GEORGE H. FOBIAN, OF MILWAUKEE, WISCONSIN, ASSIGNORS TO MAGNETIC MANUFACTURING CO., OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

MAGNETIC PULLEY.

Application filed November 26, 1920. Serial No. 426,436.

To all whom it may concern:

Be it known that we, JOHN P. BETHKE and GEORGE H. FOBIAN, citizens of the United States, residing at Milwaukee, county of Milwaukee, and State of Wisconsin, have invented new and useful Improvements in Magnetic Pulleys, of which the following is a specification.

This invention relates to magnetic pulleys for separators and is particularly directed to a magnetic pulley in which the magnets and windings rotate.

Objects of this invention are to provide a magnetic pulley having high flux density; in which the reluctance of the magnetic circuit is materially reduced; in which a better distribution of flux is secured than was formerly possible with prior constructions; and in which there are no joints in the magnetic circuit.

Other objects are to provide a magnetic pulley in which an integral construction is maintained thruout, that is to say, a plurality of magnet spools which receive the exciting winding are formed as one integral unit; in which the exciting coils are wound on comparatively shallow spools such spools forming a portion of the magnetic circuit and having their inner circular bottom parts spaced a material distance from the axis of rotation whereby an increased cross sectional area for the magnetic flux is produced; and in which improved means are provided for supporting the magnetic pulley from the shaft which, together with its integral formation, prevents sagging and other corresponding distortions.

Other objects are to provide a magnetic pulley in which the current density in the exciting winding may be very high without producing an objectionable rise in temperature during continued operation; in which improved means are provided for cooling the pulley; in which each winding is separately cooled by providing for circulation of air around such winding independently of the cooling of the other windings; in which centrifugal force is employed to aid in the cooling of the magnetic pulley; and in which each winding is encased and protected from contact with the cooling medium thereby protecting the windings from abrasions caused by particles entrained in the cooling air.

Other objects are to provide a magnetic pulley of simplified construction in which the machine work is materially lessened and the cost of production decreased.

Embodiments of the invention are shown in the accompanying drawings, in which:

Fig. 1 is a longitudinal sectional view of a magnetic pulley illustrating one form of the invention.

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1.

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1.

Fig. 4 is an elevation partly in section of a modified form of construction.

The magnetic pulley comprises a plurality of spool sections 1, 2 and 3 having outwardly diverging flanges 4 to 9 inclusive with the intermediate flanges integrally joined, that is to say, the flanges 5 and 6 and the flanges 7 and 8. This form of construction is preferably secured by casting the spool sections integrally as a single unit. In the form illustrated, three spool sections have been shown but it is to be understood that any number may be employed. For instance, a wide pulley may be employed for a separator adapted to handle a large quantity of material, or on the other hand, a single spool section may be employed for a separator of limited capacity.

These integral spool sections may be conveniently supported upon the driving shaft 10 by means of a pair of end members, one of such members 13 comprising an integrally formed circular disk provided with spokes and with a hub adapted to be keyed as indicated at 14 to the driving shaft, and the other of such members comprising a pair of semicircular disks 11 and 12 provided with spokes 15 and 16 and with half spokes 17 and 18. The last described end member is designed to have its half spokes secured together by means of a pair of bolts 19 and 20 thereby clamping the recessed portion 21 upon the drive shaft. It is to be noted that the recessed portion 21 is designed to fit a reduced portion 22 formed upon the drive shaft to thereby cause the recessed upper portion 21 to be positively positioned be-

tween the shoulders 23 and 24 formed upon each side of the recessed portion 22, thereby permanently positioning the pulley upon the drive shaft. These end members may advantageously be made of non-magnetic material to prevent leakage of flux to the shaft or other adjacent magnetic parts.

Each spool section is bridged by a non-magnetic band as indicated at 25 to 27, inclusive, to thereby complete the encasing of the exciting windings 28 to 30, inclusive. Non-magnetic end rings 31 and 32 are secured to the ends of the pulleys by means of bolts 33 and 34 which also secure the end members in position, such end members 11, 12 and 13 fitting within circular recesses formed in the ends of the integral spool sections and in the non-magnetic end rings. If desired, these end rings may be provided with flanges 35 and 36 aligning with the outer periphery of the magnetic pulley.

Each of the flanges 4 to 9 projects outwardly and forms a portion of the outer periphery of the magnetic pulley, their outer surfaces aligning with the non-magnetic bands 25 to 27 and with the non-magnetic flanges 35 and 36 thereby forming a composite smooth outer surface of the magnetic pulley in which magnetic sections and non-magnetic sections alternate.

It will be seen from an inspection of Fig. 1 that the spool sections are spaced a material distance radially outwardly from the driving shaft 10 thereby providing an increased sectional area for the magnetic flux. It will also be seen that no joints are formed in the magnetic circuit and that the flux may therefore pass thru a continuous integral magnetic circuit thruout the magnetic pulley. A material increase in the efficiency of the magnetic pulley results from this construction as there is, in the first place, no constriction of the magnetic flux at any point, and, in the second place, the reluctance of the magnetic circuit is materially further reduced due to the absence of joints in the magnetic circuit. By avoiding joints between the flanges of successive spool sections an increased flux may pass into an unequally distributed pile of magnetic material upon the conveyor belt as the flux passes into such material not only from the spool section immediately below it, but also from adjacent spool sections without traversing joints in the magnetic circuit in the pulley.

Fig. 4 shows the modified form of construction which is similar to that shown in Fig. 1 in all essential particulars except as regards the manner of supporting the pulley from the driving shaft. In this form of the invention, the magnetic pulley 37 is formed integrally with the supporting hubs 38, suitable integrally formed spokes 39 serving to connect the main body portion of the pulley with the hub.

In either form of the invention, the lead wires may pass from the slip rings 40 thru a conduit 41 formed in the driving shaft and outwardly to the exciting windings thru a similar conduit formed in one of the spoke sections.

Provision is made for ventilating this pulley by forming the spool sections hollow to allow circulation axially of the pulley. It will also be noted that each winding is encased in a spool section whose sides are exposed to the circulating air, thereby materially increasing the cooling action of the air. It will be noted that at the point of union of each of the adjacent flanges a series of openings 42 are provided. Such openings may conveniently be formed of rectangular outline so as not to reduce the cross-sectional area of the flanges. These openings allow for the centrifugal discharge of air from the interior of the pulley exteriorly and thereby cause a circulation of air to be maintained outwardly along the juxtaposed surfaces of adjacent spool sections.

It will thus be seen that a magnetic pulley has been produced in which an increased current density may be employed without an objectionable rise in temperature; in which an increased flux density may be secured; and in which an improved mechanical construction has been attained.

We claim:—

1. A magnetic pulley comprising an integral hollow magnetic pulley provided with a plurality of adjacent annular channels, and exciting windings positioned in said channels, whereby adjacent annular magnetic poles are produced.

2. A magnetic pulley comprising an integral hollow magnetic member having open ends, a plurality of exciting windings positioned upon the outer periphery of said member, such exciting windings being encased, whereby said pulley provides a magnetic path free from joints within said pulley under all conditions of loading, and whereby said windings are completely protected while still permitting interior and exterior cooling thereof.

3. A magnetic pulley comprising an integral hollow magnetic member provided with a plurality of shallow channels formed upon its exterior surface, exciting windings in said channels, and protecting members closing said channels and forming a portion of the exterior surface of said pulley, whereby said magnetic pulley presents a flux path free from joints in said pulley under all conditions of loading.

4. A magnetic pulley comprising an open hollow integral magnetic drum section, and a plurality of exciting windings positioned thereon, said drum section having ventilating openings positioned between successive exciting windings and placing the interior

of said pulley in communication with the exterior at a plurality of points.

5. A magnetic pulley comprising an integral hollow magnetic member having a plurality of annular channels formed upon its exterior, and a plurality of exciting windings positioned within said channels, the interior of said magnetic member conforming to said channels to provide internally distinct spool sections, whereby cooling may take place around all sides of each exciting winding independently of the cooling of the other exciting windings, and whereby an unbroken flux path is provided within the pulley under all conditions of load.

6. A magnetic pulley having a plurality of integrally joined internally and externally distinct spool sections, and a plurality of exciting windings positioned within said spool sections.

7. A magnetic pulley comprising an integral magnetic drum section, an exciting winding thereon, a driving shaft positioned in axial alignment with said drum section and provided with a reduced portion, and a split, supporting spider for said drum section adapted for engagement with said reduced portion, to prevent longitudinal shifting of said pulley upon said shaft, and adapted to fit within a portion of said drum section to aid in preventing separation of the portions of said spider.

8. A magnetic pulley comprising a magnetic drum member formed of a plurality of spool sections having divergent flanges with abutting flanges of adjacent sections integrally joined, and having a plurality of openings extending thru said integrally joined flange sections and placing the interior of said pulley in communication with the exterior at a plurality of points, and a plurality of exciting windings positioned within said sections.

9. A magnetic pulley comprising an integral member having an internal cavity open to the exterior provided with a plurality of annular channels, and exciting windings positioned within said channels to form consequent poles between successive windings.

10. A magnetic pulley comprising a plurality of spool shaped sections integrally connected together in spaced relation, and a corresponding number of exciting windings each associated with one of said sections.

JOHN P. BETHKE.
GEORGE H. FOBIAN.

Witness:
J. Moss.