M. WALKER.

MAGNETIC CLUTCH.

APPLICATION FILED JULY 11, 1916.

1,327,506.

Patented Jan. 6, 1920.

2 SHEETS—SHEET 1.

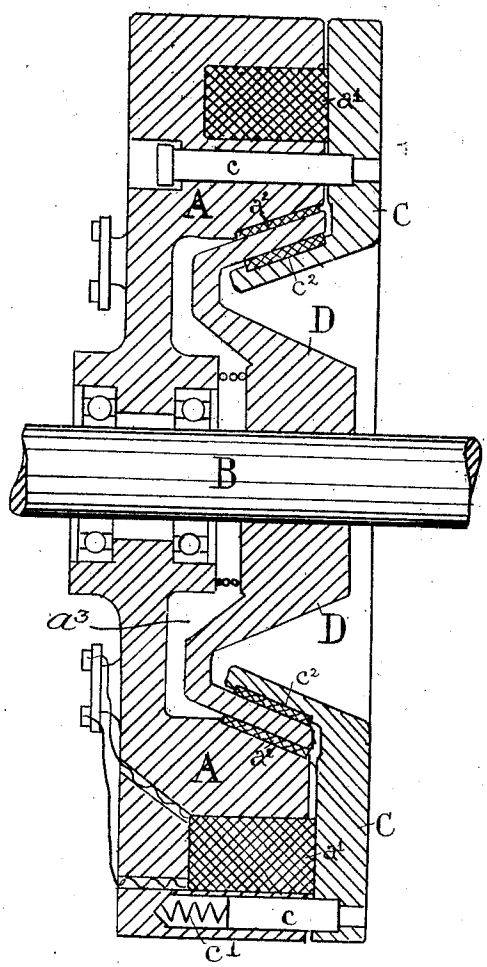


Fig. 1.

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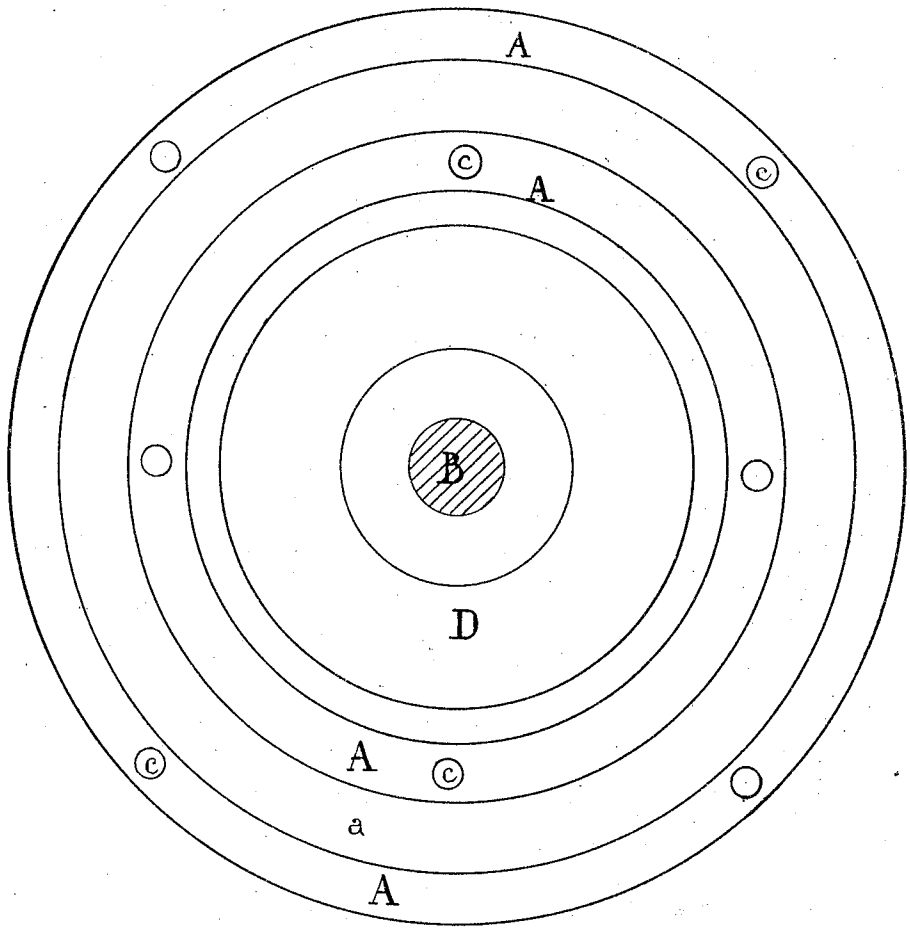


Fig. 2.

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UNITED STATES PATENT OFFICE.

MALCOLM WALKER, OF GLASGOW, SCOTLAND, ASSIGNOR TO SMITH AND COVENTRY LIMITED, OF SALFORD, ENGLAND.

MAGNETIC CLUTCH.

1,327,506. Specification of Letters Patent. Patented Jan. 6, 1920.

Application filed July 11, 1916. Serial No. 108,603.

To all whom it may concern:

Be it known that I, MALCOLM WALKER, a British subject, residing at city of Glasgow, Scotland, have invented certain new and useful Improvements in Magnetic Clutches, of which the following is a specification.

This invention relates to annular magnetic clutches the armature of which is mechanically connected to the magnetic member to rotate with it, while free to move axially to and from it under the influence of the magnetic force to throw the clutch into and out of action and the driven member is clamped between the magnet and its armature when the magnet is energized.

It consists of the particular construction and disposition of the parts comprising an annular magnet with a cone friction surface, an annular armature suspended upon studs close to the polar face of the field frame, a cone friction member interposed between the annular magnetic member and the annular armature and forced into frictional contact with the former or with both by the axial movement of the armature, and in the combination of two such friction members with a central driving disk or block to provide a reversing motion.

The invention will be fully described with reference to the accompanying drawings:—

Figure 1. is a sectional elevation of a single clutch.

Fig. 2. is a front elevation of the magnetic member.

The clutch is constructed with an annular magnet or magnetic member A provided with an annular recess a^3 forming a horse shoe shape in cross section and also with a recess a in which the energizing electric coil a' is inserted. The magnetic member A is mounted loose on the shaft B to be driven preferably on ball or anti-friction bearings so as to run freely thereon without friction. It is formed with a cone friction surface at a^2.

An annular armature C is suspended upon and close to the polar face of the magnetic member A and mechanically connected thereto so as to rotate with it while free to move toward it when attracted by the magnet and from it when the magnetic attraction is absent. To the face of the armature C a number of studs or plungers c are affixed which fit loosely into holes or recesses formed in the face of the magnetic member A. These studs serve to support the armature in position. Springs c' may be inserted behind some of the studs to force the armature out of contact with the magnetic member. We thus obtain an extra fly wheel effort by adding the armature to the field (revolving) part.

A friction member D of cone shape is placed between the magnetic member A and the armature C which when the armature is attracted by the magnet is forced into contact with the friction surface a^2 of the magnetic member A. The position of the friction member D is within that of the magnetic field and such that the magnetic flux does not pass through it. The power is thus transmitted by friction only through the entirely separate cone clutch member D by generating a high magnetic saturation of the field frame and armature.

From inspection of the drawings disclosing the foregoing structure it could be easily assumed that the clutch member D is within the magnetic field, but such, however, is not the case. It will be seen that the inner magnet ring or limb has a cone on it on the inner side which causes the limb or ring to be thicker at the yoke end than at the pole face end, and, as a consequence, the magnetic density at the thick part of the ring or limb is considerably less than the density at the thin end or polar face, and even at this face the induction value of the lines of force per square inch is of a low value as compared with usual practice in dynamos or motor design so that any leakage of field is extremely small even at the sharp corners or edges of the pole faces. There is no field whatever issuing through the cone face on the under side of the inner magnet ring for two reasons:—First, the low magnetic density used in the system, and, second, the very great reluctance between the cone face and the extended part of the ring armature which forms the pressure surface pushing in and engaging the clutch. It naturally follows, therefore, that the magnetic field does not pass through the friction member at all, the field being situated above this member and entirely clear of the friction member in every way.

In order that the application of the clutch may be gradual, there may be arranged in the circuit of the electro-magnet a rheostat

the resistances of which are gradually cut out during the operation of a switch member which thus controls the application of the clutch.

In operation the magnetic member A and the armature C rotate together and when the former is energized by the electric current the armature being attracted toward the member A carries with it cone friction member D bringing the friction members into contact. The armature C being mounted upon and rotating with the magnetic member A increases the inertia which is of advantage more especially in a reversing motion causing it to come into action more quickly than when the armature is separate from the magnetic member.

What I claim as my invention and desire to protect by Letters Patent is:—

1. A magnetic friction clutch comprising a magnetic member provided with an annular recess forming a horseshoe shape in cross-section and having an electric coil inserted therein, the magnetic member having an inner cone face within the magnetic field body provided by said member, a shaft upon which the said magnetic member is loosely mounted and free to rotate, a ring armature mechanically suspended upon and close to the polar face of the magnetic member and having an inner angular extension near the cone face of the magnetic member, a separate cone-shaped friction member interposed between the magnetic member and said ring armature extension for engagement with the cone face of the magnetic member when the latter is energized, the friction member being within the said magnetic field of the magnetic member and the said armature practically carrying the whole of the magnectic lines of force induced by the magnetizing coil to avoid dispersion or loss of lines of force and further to establish an equality of attractive pull between the armature and the magnet poles whereby an even engagement between the two cone faces is effected, and means between the shaft and the said friction member for rotatably connecting the clutch to the shaft.

2. A magnetic friction clutch comprising a magnetic member with an annular recess providing a cone friction surface, an energizing coil inserted in the said member, the cone friction surface of the member being within the magnetic field provided by said member, a shaft upon which the said magnetic member is loosely mounted, a ring armature mechanically suspended by and and movable to and from the polar face of the magnetic member and rotatable with said member, said armature having an inner angular extension at the same angle as and near the cone surface of the magnetic member, and a cone friction member mounted in the recess of the magnetic member between the cone surface thereof and the armature, the friction member being so disposed relatively to the magnetic field that the magnetic flux does not pass therethrough, the power being transmitted by friction solely through the said friction member by generating a high magnetic saturation of the field frame and armature.

3. A magnetic friction clutch comprising a magnetic member provided with an annular recess forming a horseshoe shape in cross-section and having an electric coil inserted therein, the annular recess providing an inner cone face within the magnetic field body of the said member, a shaft on which the magnetic member is loosely mounted, a ring armature suspended upon and close to the polar face of the magnetic member and having mechanical devices loosely engaging said member to cause the armature to rotate with the latter, the ring armature having a part thereof projecting adjacent to the cone face of the magnetic member, and a friction member of cone shape disposed between the cone face of the magnetic member and the part of the armature adjacent to said latter cone face and within a part of the recess of the magnetic member, the friction member being so disposed that the magnetic flux does not pass therethrough and the power is transmitted by friction solely through the friction member by generating a high magnetic saturation of the field and armature.

4. A magnetic friction clutch comprising a magnetic friction member having a recess forming a cone face and an energizing electric coil inserted in the body of the member at a distance outwardly from the said recess, the cone face being exterior of the magnetic field, a shaft on which the said magnetic member is loosely mounted, a ring armature suspended close to the polar face of the magnetic member and also provided with a cone friction face at its inner portion which is normally adjacent to the cone face of the magnetic member, the ring armature being movable toward and from and also rotatable with the magnetic member, and a friction member mounted to move between the cone face of the magnetic member and the cone face of the ring armature and having two cone friction faces, one of said faces engaging the cone face of the magnetic friction member and the other the cone face of the ring armature, and means for connecting the friction member with the device to be driven.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses this 7th day of June 1916.

MALCOLM WALKER.

Witnesses:

WALLACE CRANSTON FAIRWEATHER,
DOUGLAS KEITH FAIRWEATHER.