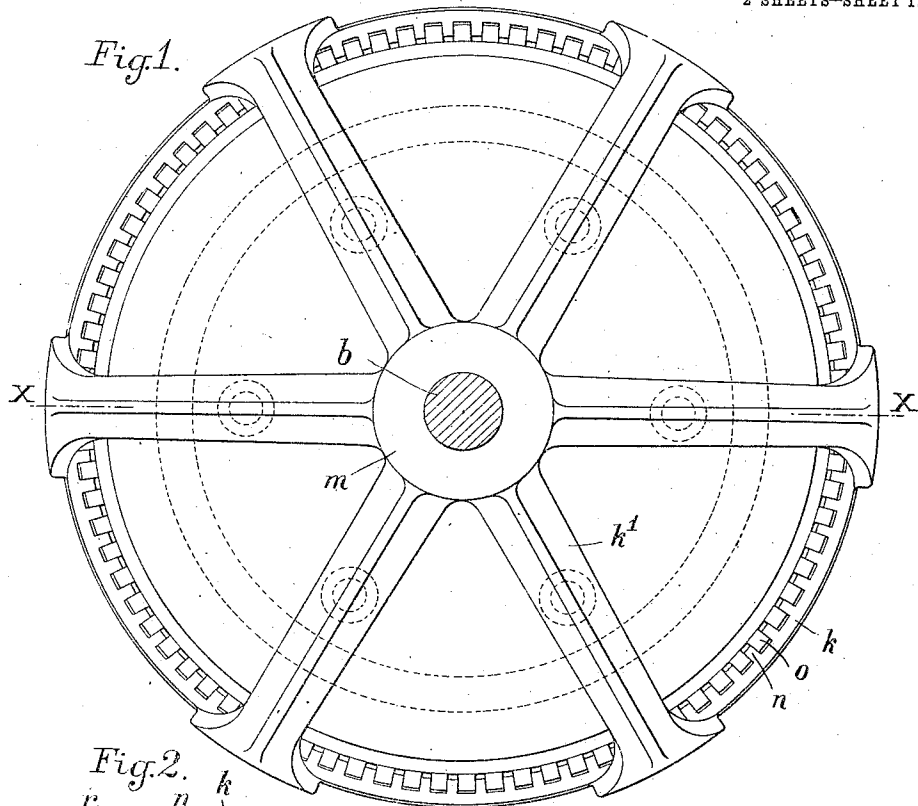
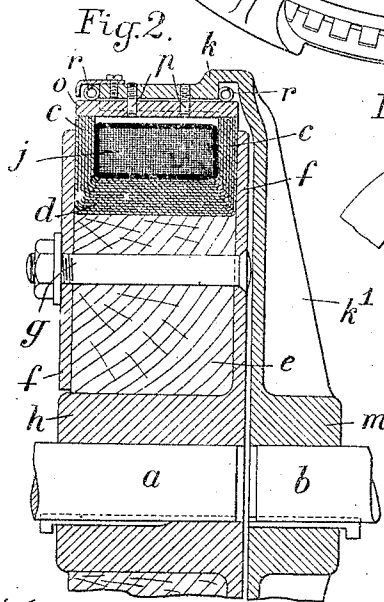
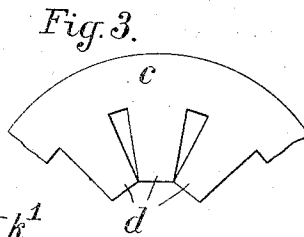
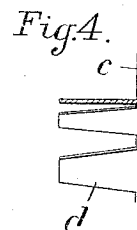
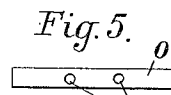
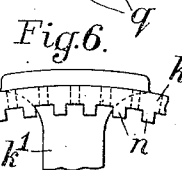


A. T. COLLIER.
MAGNETIC CLUTCH.
APPLICATION FILED NOV. 7, 1912.

1,077,805.

Patented Nov. 4, 1913

2 SHEETS—SHEET 1.



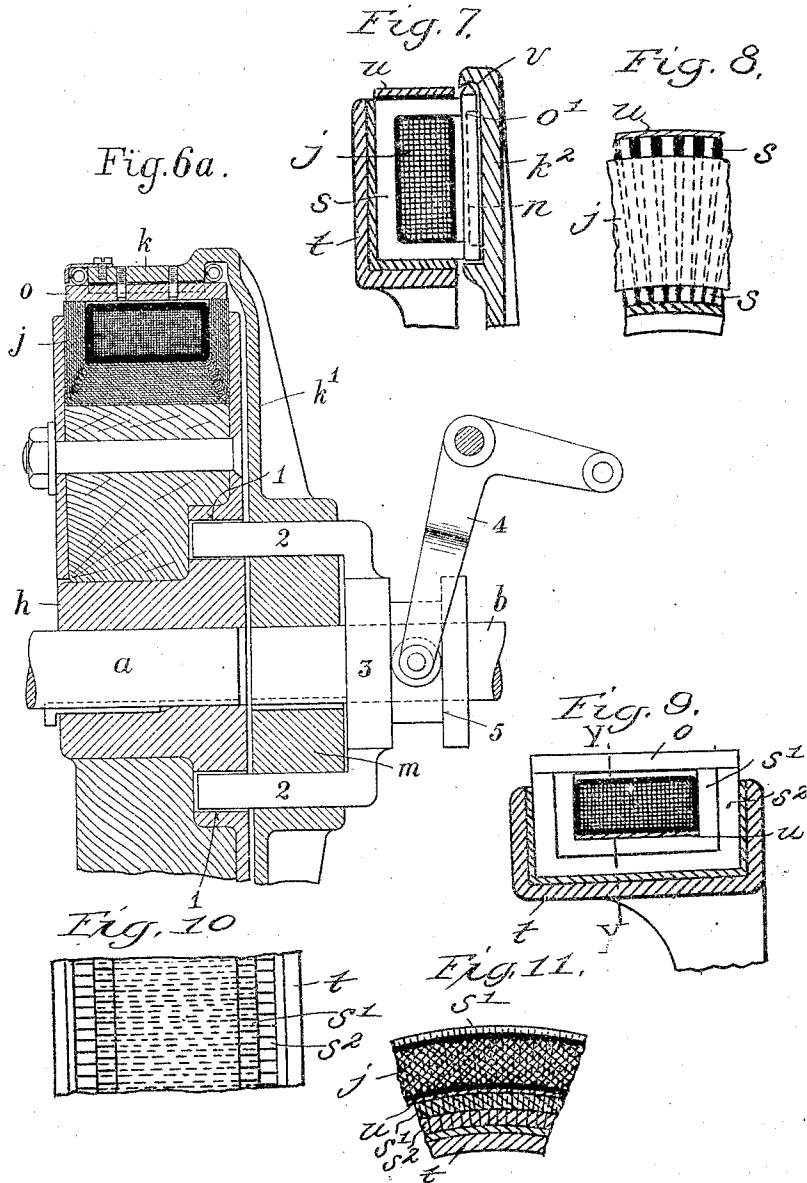
Witnesses:
M. E. McRae.

Inventor
Arthur T. Collier
by James L. [Signature] Atty.

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2 SHEETS—SHEET 2.



Witnesses:
John Bourne.
C. H. Kessler

Inventor
Arthur T. Collier
by James L. Norris,
Attorney.

UNITED STATES PATENT OFFICE.

ARTHUR THOMAS COLLIER, OF ST. ALBANS, ENGLAND, ASSIGNOR OF ONE-THIRD TO
JAMES DANGERFIELD, OF LONDON, ENGLAND.

MAGNETIC CLUTCH.

1,077,805.

Specification of Letters Patent.

Patented Nov. 4, 1913.

Application filed November 7, 1912. Serial No. 730,038.

To all whom it may concern:

Be it known that I, ARTHUR THOMAS COLLIER, a subject of the King of Great Britain, residing at St. Albans, in the county of Hertford, England, have invented new and useful Improvements Relating to Magnetic Clutches, of which the following is a specification.

This invention relates to magnetic clutches.

According to the said invention, one member of the clutch consists of an electromagnet of any suitable form preferably provided with concentrically arranged pole-pieces. The other member of the clutch consists of a carrier wherein a number of armatures of small mass are arranged transversely to the direction of motion of the polar surfaces of the electromagnet, the armatures being connected to the carrier in such a manner as to permit sufficient relative motion to enable them to move into and out of contact with the polar surfaces of the electromagnet or to enable the pressure with which said armatures bear against said polar surfaces to be varied. The said armatures may be made in the form of bars or of pieces of suitable sheet iron arranged to fit loosely in radial slots in said carrier, in such a manner that their edges bear against the polar surfaces of the electromagnet and complete the magnetic circuit thereof.

By constructing the clutch according to the said invention, it is extremely sensitive, firstly by reason of the low inertia of the relatively movable armatures, whereby they are rendered capable of moving quickly toward and away from the electromagnet, and secondly by reason of the narrowness of the surfaces of the said armatures, whereby the adhesion which is caused by the expulsion of the air from between the surfaces in contact is reduced to a minimum.

In the accompanying drawings, it is shown how the said invention, may be conveniently and advantageously carried into practice.

In these drawings: Figure 1 is a side elevation, and Fig. 2 a partial longitudinal section on the line X, X, Fig. 1, showing one form of the improved clutch. Fig. 3 is a face view and Fig. 4 a transverse section, illustrating the construction of the electromagnet core. Figs. 5 and 6 show details of the construction of the armatures and of their

seats in the carrier. Fig. 6^a is a similar view to Fig. 2 illustrating a modification. Fig. 7 is a radial section of a modified form of the improved clutch, and Fig. 8 is a face view of the electromagnet thereof looking on to the polar faces. Figs. 9 and 10 are similar views to Figs. 7 and 8 respectively and Fig. 11 a section on the line Y, Y, Fig. 9, showing a modified form of electromagnet.

a and *b* are the shafts to be coupled.

In the clutch shown in Figs. 1 to 6, the electromagnet is made with its core formed from rings *c, c* of suitable soft iron, which are provided with inwardly-extending teeth *d, d* Fig. 3. These teeth are bent at right angles, as shown in Fig. 4, and the rings *c, c* are brought together in pairs, so that the bent teeth overlap, as shown in Fig. 2. In this manner, a core is built up of the desired cross-sectional area, the outer edges of the rings *c, c* forming the annular pole-pieces. If desired, the said rings can be each provided with a radial slot to prevent the formation of eddy currents therein during variations in the strength of the magnetic field. The said rings are supported, for example, by a wooden core *e* and clamping disks *f, f'* which are drawn together by bolts *g, g* and of which one (*f*) is mounted on a hub *h* keyed to the shaft *a*. In the magnet core so formed is wound a coil *j* of suitably insulated wire.

The other member of the clutch comprises an annular carrier *k* supported by means of arms *k'* on a hub *m* keyed to the shaft *b*. The carrier *k* is provided on its inner periphery with guide-teeth *n, n* between which slide the armatures *o, o* formed of bars of suitable soft iron. These armatures are retained in the slots between the teeth *n, n* by means of pins *p, p* secured to the carrier *k* and fitting loosely in holes *q, q* in the armatures *o, o*. The armatures *o, o* are held in contact with the annular pole-pieces *c, c* by means of spiral springs *r, r* encircling the annular series of armatures, as shown in Fig. 2. These springs more or less counterbalance the centrifugal force exerted by said armatures during the rotation of the clutch. The current supplied to the electromagnet-coil *j* of said clutch is preferably made variable by connecting a suitable rheostat in series therewith, so as to enable the clutch-members to be drawn together with any desired force. By this means, the

clutch-members can be allowed to slip relatively to each other to any desired extent.

If desired, moreover, the magnetic clutch may be combined with a claw-, dog-, or other positive clutch, which may be thrown into engagement when the shafts *a*, *b* are running at the same velocity, whereupon the electro-magnet may be deenergized and unnecessary consumption of current avoided.

10 This arrangement is shown in Fig. 6^a wherein the hub *h* of the electromagnet is provided with a series of holes 1, 1 so as to form one member of a dog-clutch, the other member of which consists of a corresponding series of dogs or bolts 2, 2, sliding in holes in the hub *m* of the carrier *k* and mounted on a sleeve 3 that is movable along the shaft *b*, by means of a forked lever 4 engaging a groove 5 in said sleeve in a well-known manner.

20 In the modification shown in Figs. 7 and 8, the electromagnet is formed by a series of radially arranged and suitably insulated plates or bars *s*, *s* secured in position in a ring *t* mounted on a hub such as *h* by means of an encircling band *u*. In this case, the polar surfaces lie in a plane perpendicular to the axis of the clutch and the radially arranged armatures *o'*, *o'*, are pivotally supported at their outer ends in a channel *v* in the carrier *k*² which is provided with guide-teeth *n* in a similar manner to the carrier *k*, Figs. 1 to 6. By this means, the centrifugal force acts on the groove *v* and has practically no effect on the movement of the armatures *o'*, *o'*, toward and away from the poles of the electromagnet. If desired the armatures can be arranged with their longitudinal axes inclined at such angles to the axis of the clutch that the centrifugal forces assist or resist the attractive force of the electromagnet.

In the modification shown in Figs. 9, 10 and 11, the electromagnet core-plates are wedge-shaped and are made in two series *s'*, *s''*, nested one in the other, the plates of one series being staggered relatively to those in the other series. The plates *s'*, *s''*, can be secured in position by means of a band *u* or in any other suitable manner. By this means, more uniform polar surfaces can be obtained on which the armatures bear.

The clutch can be arranged to run in an oil-bath or in a water-trough, the electromagnet coil being suitably protected from the action of the liquid; or the electromagnet or the armature-carrier or both can be provided with water jackets in order to prevent rise of temperature during use.

40 Instead of using an electromagnet with a laminated iron system as above mentioned, it is sufficient in many cases to employ an electromagnet with its core and pole-pieces formed of solid or unlaminated metal.

65 The carrier or the part thereof adjacent

to the armatures, may moreover be made of an electric insulator, such as vulcanized fiber, for example, when it is desired to supply the clutch-magnet with an intermittent or undulatory electric-current.

The polar faces of the electromagnet, and therefore also the movable armatures, may also be arranged on one or more conical surfaces; or they may be arranged on the inside of cylindrical surfaces.

If desired, the driving faces of the slots may be cut away or recessed at their inner ends so that both surfaces (*i. e.* slot faces and armature-faces) engage with each other over their whole area and thus prevent the formation of ridges by wear. Moreover, the surfaces of the armatures in contact with the polar faces of the electromagnet can be suitably hardened to reduce wear.

I claim:

1. A magnetic clutch, one member of which comprises an electromagnet having concentric pole-pieces arranged on the surface of a figure of revolution, and the other member of which comprises a carrier and a plurality of narrow armature-bars movably supported by said carrier with their longitudinal axes lying transversely to the direction of motion of the polar faces of the electromagnet, each of said armatures being adapted to come into contact with both poles of the electromagnet.

2. A magnetic clutch, one member of which comprises an electromagnet having its pole-pieces arranged on the surface of a figure of revolution, and the other member of which comprises a carrier, and a plurality of armature-bars movably supported by said carrier with their longitudinal axes lying transversely to the direction of motion of the polar faces of the electromagnet, each armature-bar having surfaces adapted to come into direct contact with both of the pole-pieces of the electromagnet, in such a manner that the driving force is transmitted from one member of the clutch to the other through said surfaces.

3. A magnetic clutch, one member of which comprises an electromagnet having its pole-pieces arranged on the surface of a figure of revolution, and the other member of which comprises a carrier, provided with guide-teeth, and a plurality of armature-bars slidable in the spaces between said guide-teeth toward and away from the pole-pieces of said electromagnet.

4. A magnetic clutch, one member of which comprises an electromagnet having its pole-pieces arranged on the surface of a figure of revolution, and the other member of which comprises a carrier, a plurality of armature-bars arranged with their longitudinal axes transverse to the direction of motion of the polar faces of said electromagnet and pins engaging with slots for

supporting said armature-bars on said carrier so as to be movable toward and away from the pole-pieces of said electromagnet.

5. A magnetic clutch, one member of which comprises an electromagnet having its pole-pieces arranged on the surface of a figure of revolution, and the other member of which comprises a carrier, a plurality of armatures of small mass mounted on said carrier so as to be movable toward and away from the pole-pieces of said electromagnet and a spring adapted to hold said armatures against the polar surfaces of the electromagnet.

8. A magnetic clutch, one member of which comprises an electromagnet having alaminated core and poles, the pole-pieces being arranged on the surface of a figure of revolution, and the other member of which comprises a carrier, guide-teeth on said carrier, and a plurality of bar-armatures slidable in the spaces between said teeth toward and away from the polar faces of said electromagnet.

9. The combination of an electromagnet having pole-pieces arranged on the surface of a figure of revolution and forming one member of a clutch, a carrier and a plurality of narrow armature-bars which are movably supported by said carrier with their longitudinal axes lying transversely to the direction of motion of the polar faces of said electromagnet and are adapted to move into contact with both poles of the electromagnet, such carrier and armature-bars forming the other member of the clutch, and a dog-clutch combined with said electromagnet and said carrier and adapted to connect said electromagnet and said armature-carrier positively together.

ARTHUR THOMAS COLLIER.

Witnesses:

HERBERT A. BEESTON,
L. T. HOLMES.

10 5. A magnetic clutch, one member of which comprises an electromagnet having its pole-pieces arranged on the surface of a figure of revolution, and the other member of which comprises a carrier, a plurality of armatures of small mass mounted on said carrier so as to be movable toward and away from the pole-pieces of said electromagnet and a spring adapted to hold said armatures against the polar surfaces of the electromagnet.

15 6. A magnetic clutch, one member of which comprises an electromagnet having its iron-system formed of a plurality of sheet-iron rings, the outer peripheries of which are arranged to form pole-pieces located on the surface of a figure of revolution and the inner peripheries of which are formed with teeth bent substantially at right angles, the teeth on each ring being bent in a direction to overlap the corresponding teeth on rings forming the opposite pole-piece, the other member of said clutch comprising a carrier and a plurality of armatures of small mass mounted in said carrier so as to be movable into contact with the pole-pieces of said electromagnet.

20 7. A magnetic clutch, one member of which comprises an electromagnet having its pole-pieces arranged on the surface of a figure of revolution, and the other member of which comprises a carrier, and a plu-