

G. F. MANSBRIDGE.
IRON FREE VARIABLE INDUCTANCE.
APPLICATION FILED MAR. 26, 1908.

2 SHEETS—SHEET 1.

Fig. 1.

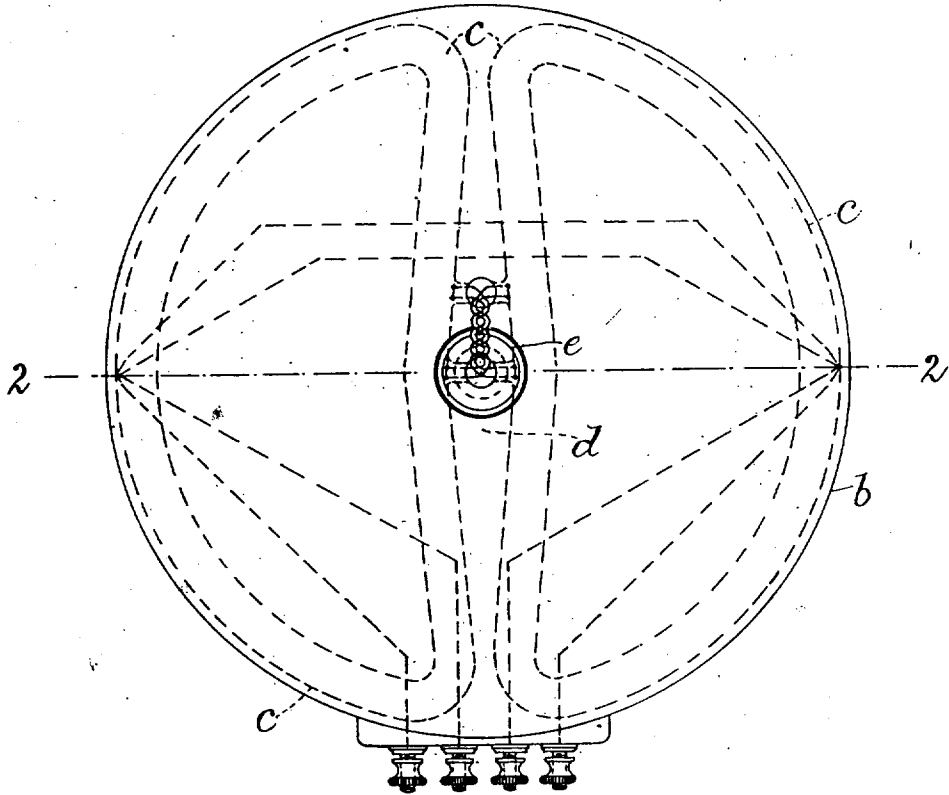
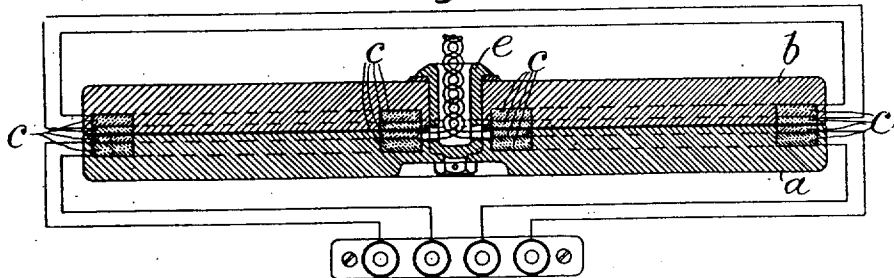


Fig. 2.



Witnesses:

Harry T. P. Gee.
Thomas H. Henderson.

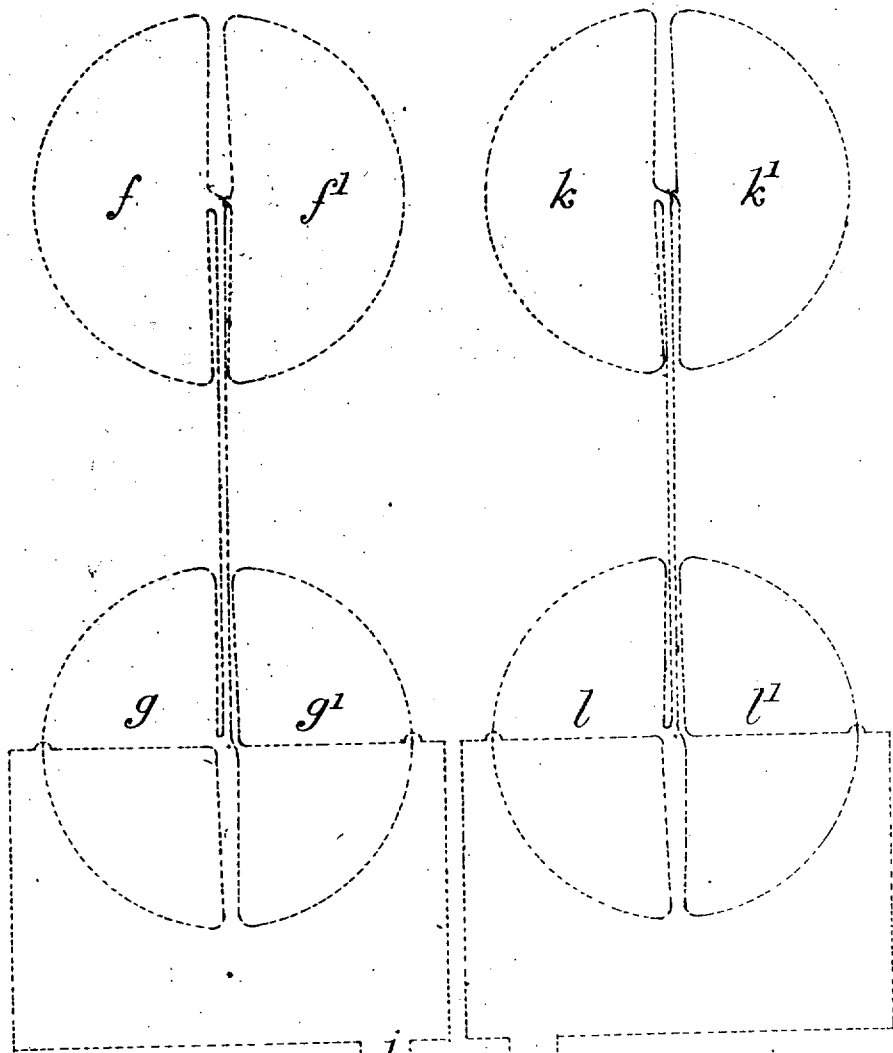
Inventor:

George Frederick Mansbridge

G. F. MANSBRIDGE.
IRON FREE VARIABLE INDUCTANCE.
APPLICATION FILED MAR. 26, 1906.

2 SHEETS—SHEET 2.

Fig. 8.



Witnesses:

Harry V. P. Lee
W. W. Ward.

h i j m n

Inventor:

George Edmund Mansbridge

UNITED STATES PATENT OFFICE.

GEORGE FREDERICK MANSBRIDGE, OF SANDERSTEAD, ENGLAND.

IRON-FREE VARIABLE INDUCTANCE.

No. 893,340.

Specification of Letters Patent.

Patented July 14, 1908.

Application filed March 26, 1906. Serial No. 308,186.

To all whom it may concern:

Be it known that I, GEORGE FREDERICK MANSBRIDGE, subject of Edward VII, King of Great Britain and Ireland, and residing at 5 St. Margaret's, Sanderstead Road, Sanderstead, in the county of Surrey, England, have invented certain new and useful Improvements in Iron-Free Variable Inductances, of which the following is a specification.

10 This invention relates to iron-free electrical coils the inductance of which can be readily varied or adjusted as may be desired, and which comprise a stationary coil-carrying member and a mechanically movable 15 coil-carrying member.

For the sake of convenience, I have referred, in the body of this specification, to the embodiment of my invention in the form 20 of instrument which, as hitherto constructed, comprises four circular coils of insulated wire mechanically mounted upon or embedded within separate disks, two coils on each 25 disk, the disks being so arranged on a common axis that one disk can be mechanically, as distinguished from electro-magnetically, rotated relatively to the other, suitable electrical connections being also provided.

30 The object of the invention is to increase the time-constant of the coils when used for low inductance values, to increase the range obtainable from any one instrument, and to obtain a more uniform scale than can be 35 obtained from similar instruments as at present made.

To this end I employ shallow coils which are of the largest practicable area, and some or all of which may be sectionally-wound, set as nearly as possible flush with the surface 40 of the disks, so that when the windings in one disk are immediately over those in the other disk, they form practically one coil, and thus produce the maximum effect of combination or neutralization, depending 45 upon whether the currents in the adjacent windings are in the same or in the opposite direction.

The accompanying drawings show, in Figure 1, a plan of an iron-free variable inductance constructed according to this invention, Fig. 2 being a section on line 2—2 50 of Fig. 1. Fig. 3 is a diagrammatic representation of the electrical connections.

In Figs. 1 and 2 of the drawings, *a* is the 55 stationary coil-carrying member, in the form of a disk, and *b* the mechanically movable

coil-carrying member, also in the form of a disk, Fig. 1 showing a convenient shape for the coils *c*, whereby a central space *d* is left for the mechanical swiveling attachment *e*. 60

In Fig. 2 may be seen the sectional winding of the coils *c* and a convenient section for them.

As shown in Fig. 2 the sectional winding is arranged as follows:—The lower disk *a* carries a long coil superposed by a short coil, while in the upper disk *b*, a short coil is superposed by a long coil. It is to be understood that the words "long" and "short" as herein used and as applied to the coils 70 are merely relative and that they indicate respectively that the windings are of greater or fewer turns. In Fig. 2 the long coil is shown approximately twice as thick as the short coil in order to indicate that it has 75 approximately twice the length and consequently twice the number of turns, this ratio of 2 to 1 being the most generally convenient.

Referring now to Fig. 3, which illustrates 80 in diagrammatic form the electrical connections of the sectional winding of the coils of the instrument shown in Fig. 2, the two coils *f*, *f'*, comprising the short section of the winding on the upper disk are permanently 85 connected in series with the two coils *g*, *g'* which comprise the short section of the windings of the lower disk, the terminals *h*, and *j* representing the two ends of the circuit. *k*, *k'*, show the long section of the 90 winding on the upper disk and these coils are permanently connected in series with the coils *l*, *l'*, which constitute the long section of the winding on the lower disk. The coils *k*, *k'* and *l*, *l'*, are respectively connected to the 95 terminals *m* and *n*. *o* is a brass strip for connecting the terminals *j* and *m* together whereby the whole of the winding is made use of. By making connection with the terminals *h* and *j* only, the sections *f*, *f'*, and *g*, *g'*, 100 are alone brought into use and this renders available a comparatively low range of inductance, for example, from 1 to 10 millihenrys, but when the terminals *j* and *m* are joined together by the strip *o*, and connection is made 105 with the terminals *h* and *n*, the whole of the winding is employed, and a comparatively high range of inductance is then available, for example, from 10 to 100 millihenrys. By this arrangement it will be seen that the coils 110 *f*, and *f'*, and *k* and *k'*, although brought to separate electrical connections, form practi-

cally one coil. Similarly with regard to g and g' and l and l' , and, if the instrument is wound in three or more sections, the same construction as herein described is followed throughout, a separate pair of terminals being used for each section.

By my invention I modify the construction of the instruments so as more usefully to employ the space and wire available, and I do this in the following manner. Instead of using four simple circular coils arranged in pairs, I use four sectionally wound coils of approximately semi-circular form, arranged in pairs and with their straight sides adjacent. The best form for the purpose is semi-circular but mechanical considerations will not conveniently allow of the coils being made absolutely semi-circular. I may use half-hexagon, half-octagon, or even elliptical coils as giving better results than circular coils. This modification gives the following advantages:—

(a) by winding each coil in two or more (preferably unequal) sections and connecting these sections to separate terminals, I obtain in the same instrument several ranges of inductance, *e. g.*, a low range when using one section of the winding and a higher range when using a larger section or preferably the whole of the winding. The total range thus obtained is greater than can be obtained with simple coils, and the time-constant for the low inductance values is increased since a part of the resistance is cut out of circuit.

(b) by using semi-circular coils with their straight sides adjacent, I obtain a practically uniform scale and at the same time I increase the time-constant of the instrument since stouter wire may be used consequent upon the increased space available. Further, the plan of bringing the sections to separate terminals permits of the instrument being used as a variable standard of either self or mutual induction.

Obviously the plan may be employed of using only two coils (simple or sectionally wound), one on each disk, but this plan involves the use of a greater length of wire for the same range of inductance. By these means, without a great increase of cost, I obtain (a) an increased range of inductance, (b) a higher time-constant than can be obtained with circular coils in instruments of this type, and (c) a practically uniform scale.

To obtain the highest inductance the coils in each disk should be arranged with their straight sides as close together as possible, but, in order to adopt the well known and convenient method of swiveling the upper disk from its center, as employed in instruments of this type, I shape the coils in both disks in such a manner as to leave a space at the center wherein the swiveling attachment may be mounted. Further, the windings in each disk should be arranged as close as prac-

ticable to the inner face of the disk so as to reduce to a minimum the distance between the faces of the coils in one disk and those on the other. I do not however limit myself to the precise shape and section shown.

In certain cases it is desirable that the electrostatic capacity of the system be as small as possible and to this end I wind and connect the coils so that a current flowing through them produces the minimum potential difference between the parts most closely adjacent one to another when the instrument is adjusted to the position of minimum inductance.

I may, if desired, employ sectionally-wound circular coils. Also, in any one instrument, I may employ coils having a combination of simple and sectional windings. Further, I may use semi-circular simple wound coils.

Claims:—

1. In an iron-free variable inductance having one stationary coil-carrying member and one mechanically movable coil-carrying member, a plurality of semi-circular shallow coils, part of these coils being on the stationary member and the remaining part on the movable member.

2. In an iron-free variable inductance having one stationary coil-carrying member and one mechanically movable coil-carrying member, a plurality of sectionally-wound semi-circular shallow coils, part of these coils being on the stationary member and the remaining part on the movable member.

3. In an iron-free variable inductance having one stationary coil-carrying member and one mechanically movable coil-carrying member, the combination with the stationary coil-carrying member, of semi-circular shallow coils carried thereby, semi-circular shallow coils carried by said movable member, and means for connecting said members together so that the faces of the coils in the movable member may be mechanically moved over the faces of the coils in the stationary member.

4. In an iron-free variable inductance having one stationary coil-carrying member and one mechanically movable coil-carrying member, the combination with the stationary coil-carrying member of semi-circular shallow coils, wound in sections, carried thereby, semi-circular shallow coils, wound in sections, carried by said movable member, electrical connections so arranged that the said sections may be used singly or together, and means for connecting said members together so that the faces of the coils in the movable member may be mechanically moved over the faces of the coils in the stationary member.

5. In an iron-free variable inductance having one stationary coil-carrying member and one mechanically movable coil-carrying

member, the combination with the stationary coil-carrying member of semi-circular shallow coils wound in unequal sections carried thereby, semi-circular shallow coils wound in unequal sections carried by said movable member, electrical connections so arranged that the said sections may be used singly or together, and means for connecting said members together so that the faces of the coils in the movable member may be mechanically moved over the faces of the coils in the stationary member.

6. In an iron-free variable inductance having one stationary coil-carrying member and one mechanically movable coil-carrying member, a plurality of sectionally-wound shallow coils, part of these coils being on the

stationary member, and the remaining part on the movable member.

7. In an iron-free variable inductance having one stationary coil-carrying member and one mechanically movable coil-carrying member, a plurality of, sectionally-wound shallow coils wound in unequal sections, part of these coils being on the stationary member and the remaining part on the movable member, and electrical connections so arranged that said sections may be used singly or together.

GEORGE FREDERICK MANSBRIDGE.

Witnesses:

HARRY T. P. GEE,
E. HADGRAFT.