Jan. 12, 1926. 1,569,801

H. P. DONLE

INDUCTIVE COUPLER

Filed Oct. 22, 1923

Fig. 1.

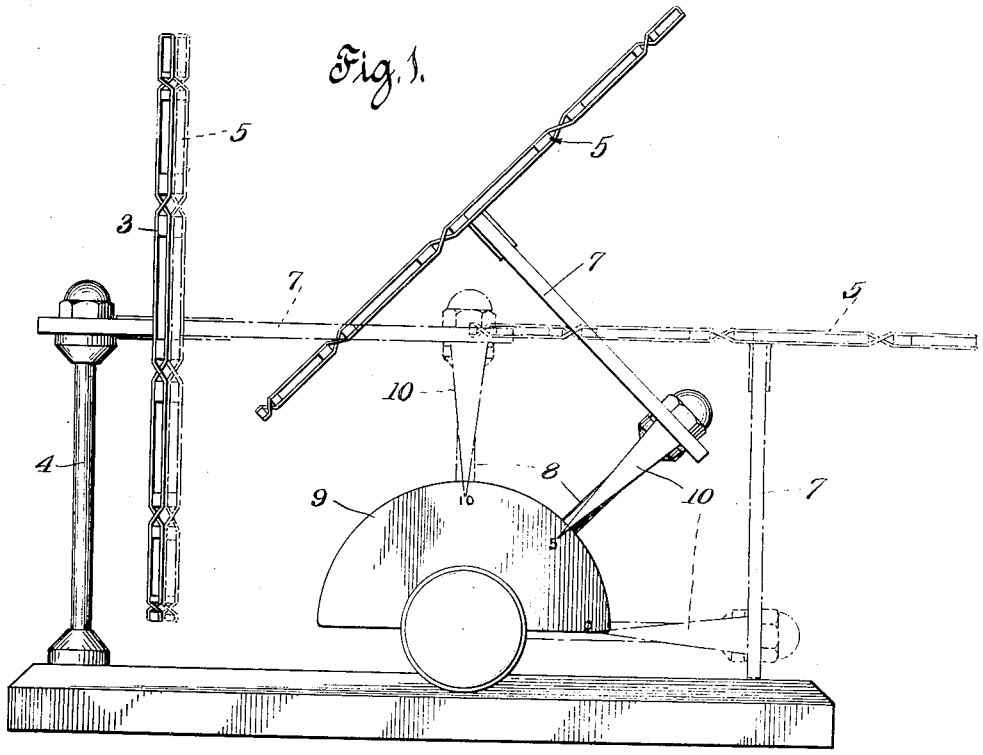
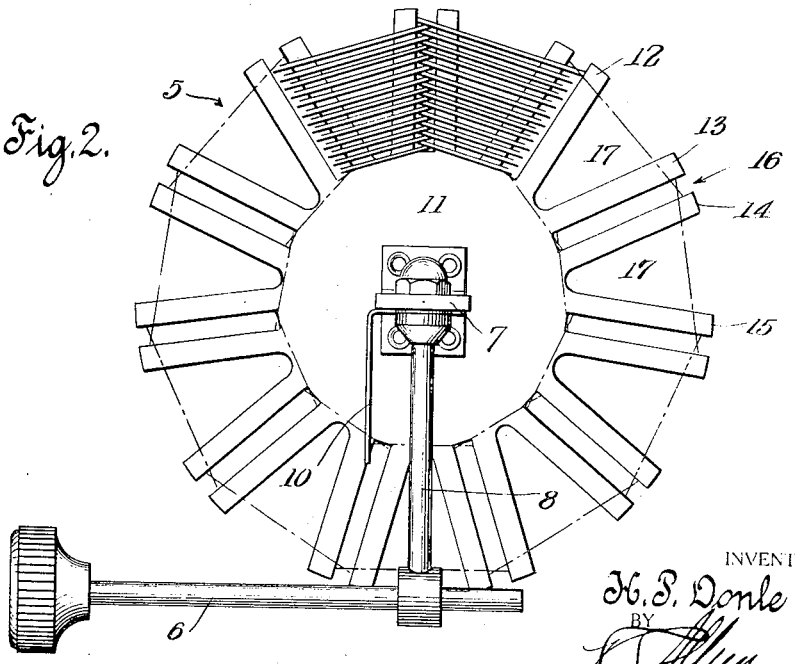


Fig. 2.



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INDUCTIVE COUPLER.

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To all whom it may concern:

Be it known that I, HAROLD P. DONLE, a citizen of the United States of America, residing at Meriden, New Haven County, Connecticut, have invented a new and useful Inductive Coupler, of which the following is a specification.

The primary object of my invention is to provide a simple instrument for magnetically coupling two electric circuits, the instrument having such characteristics that (1) a large range of magnetic coupling, extending from exceedingly close to substantially or actually zero, may be had and (2) the electrostatic coupling of the coil systems will be reduced to a minimum value as the inductive coupling is reduced. Otherwise stated, one object is to provide a simple mounting whereby the mutual inductance of two coils may be varied from a high value to zero, the reduction of mutual inductance being automatically accompanied by a substantial reduction in the electrostatic capacity of one coil with respect to the other. It is specifically sought to obtain a maximum range of magnetic coupling in a compact device of low minimum static coupling. Further objects are to secure a rugged, easily adjusted and relatively inexpensive form of inductive coupler having the above described desirable characteristics.

A number of different forms of coupling devices have been heretofore used, but all forms so far as I am aware have disadvantages inherent in their mechanical structures. In one form of device coils are mounted on a common axis, one coil being movable longitudinally with respect to the other. In this form, while it is possible to obtain a wide range of coupling by separating the coils to a considerable distance, and although the electrostatic coupling is low when the magnetic coupling is loose, the construction is necessarily bulky in order to provide the necessary wide separation of the elements. In another form of device the coils are concentrically mounted and one is adapted to be tilted or rotated with respect to the other. While this form provides a wide range of magnetic coupling and in fact permits zero magnetic coupling to be obtained, the electrostatic capacity between the coils is at all times high so that the full advantages of loose coupling cannot be obtained. In order to avoid the objections to the two preceding forms, composite structures have been proposed in which there is both relative rotation and translation of one coil with respect to the other. This construction however is necessarily mechanically complicated and expensive, and so far as I know has never met with any commercial success. Another form of construction mounts one coil entirely outside of the other but on an axis so that it may be tilted. It is impossible in this type of construction to obtain both a close magnetic coupling and a low static coupling. Still another form of construction very considerably used hinges one or more members with respect to another like the leaves of a book. When such a construction is made in compact form it is impossible with it to obtain loose coupling either magnetic or static, in fact, in order to obtain low magnetic coupling, it is necessary to make the device of such large dimensions as to be very cumbersome.

According to my invention I have overcome these objections in a very simple manner. In its simplest form, one coil is stationary and the other coil is pivoted on an axis at right angles to the axis of the first and located at a distance away from the central plane of the movable coil substantially equal to the perpendicular distance from the axis of the coil to the axis of the pivot.

The drawing illustrates one form of construction embodying my invention.

Figure 1 is a front view showing the parts in full lines in an intermediate position of coupling and in dotted lines in the closest coupling and in the zero coupling positions respectively.

Fig. 2 is a side view of the movable coil and its supporting parts.

The coil 3 is supported by a post 4. The coil 5 is carried by the shaft 6 whose axis is at right angles to the axes of the coils 3 and 5. In the particular form shown, the connection between the coil 5 and shaft 6 includes an axial bar 7 and a radius rod 8

suitably connected together for convenience in construction and assembly. According to the best design the axis of the pivot shaft 6 is arranged to the right of the coil 3 and below its axis, the distance below the axis of the coil 3 being equal to the distance from the axis of the shaft to the central plane of the coil 5. When the coils are in their closest coupled relation they are parallel to each other and co-axial and as close together as possible. When the pivot shaft is turned 90° to the right or clockwise, the coil 5 lies in a plane containing the axis of coil 3. When in this latter position, it will be seen that the magnetic coupling is zero, and as the coils are separated at substantial distances there is an inconsequential static coupling.

For the purpose of convenient indication of the relative positions of the coils, I have provided a stationary scale plate 9 and a pointer 10, the latter being carried by the radius rod 8 or bar 7. Although I consider that the broad invention is applicable to any suitable form of coil, I have found especially desirable results in the use of thin coils such as shown in my former Patent #1,465,546. It will be seen that it is possible to bring coils of this type very close together so as to obtain a very intimate coupling. These coils have particularly high inductance with very low distributed capacity and effective resistance and are particularly suitable for radio frequency circuits having low losses. For convenience in construction each coil is preferably wound on a disc such as 11 having pairs of arms such as 12, 13, and 14, 15, which accurately hold the zigzag coil windings. Successive turns of the coils cross each other in the spaces such as 16 between pairs of arms. In order to minimize the capacity between turns, I prefer to provide air space 17 between the adjacent arms 12, 13, and 14, 15. These discs and their attached arms may be made in any suitable manner as by slotting discs of insulating material or in the moulding process. It should be understood however, that I do not consider my invention as limited to the precise details herein shown except as required by the terms of the claims.

I claim:

1. A variable inductive coupler comprising a stationary disc-like coil, a second disc-like coil, and a pivot shaft supporting said second coil, said shaft being located substantially parallel with the plane of said stationary coil and substantially at right angles to the axis of said stationary coil, the axis of said shaft being located approximately the same distance from the axis of said second coil that it is from the adjacent face of said stationary coil.

2. An inductive coupler comprising a stationary disc-like coil and a co-acting movable disc-like coil, and a pivot shaft for said movable coil, the axis of said shaft being located substantially at right angles to the axes of said coils and at distances from said axes substantially equal to the distances from the planes of said coils.

3. In an inductive coupler, a movable coil, a pivotal support for said coil, the axis of said pivotal support being located at right angles to the axis of said coil and at a distance from said axis substantially equal to the distance from the plane of said coil to the axis of said pivot, said distance being at least as great as a radius of said coil.

4. In an inductive coupling device, a coil, a pivot shaft therefor approximately parallel to the plane of the coil, a radius rod extending from said shaft, an axial bar connecting said coil and said radius rod, said radius rod and said axial bar being of substantially the same length.

5. In an inductive coupling device, a rotatable shaft, a coil and means for supporting said coil on said shaft in a plane parallel to said shaft at a distance from the axis of said shaft approximately equal to the radius of said coil and with the axis of said coil approximately the same distance from the axis of said shaft.

6. An inductive coupler comprising a stationary disc-like coil, a movable disc-like coil, a pivot shaft for the latter coil arranged approximately parallel to the central planes of said coils, and connecting means between said shaft and the movable coil such that by the simple rotation of said shaft said movable coil may be moved from a position closely adjacent said stationary coil to a position substantially at right angles thereto and with its central plane including the axis of said stationary coil.

HAROLD POTTER DONLE.