Oct. 27, 1925. 1,558,473

H. H. GORDON

VARIOCOUPLER FOR RADIO TELEGRAPHY AND TELEPHONY

Filed Oct. 22, 1923 2 Sheets-Sheet 1

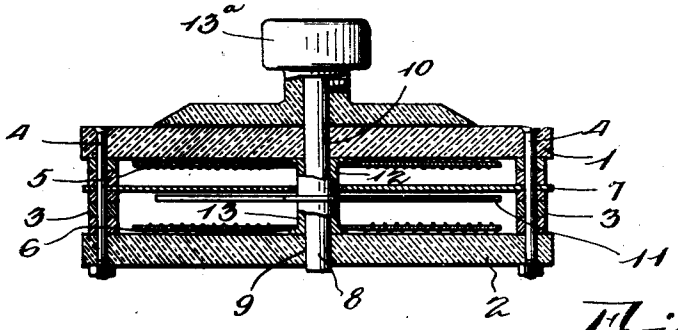


Fig. 1.

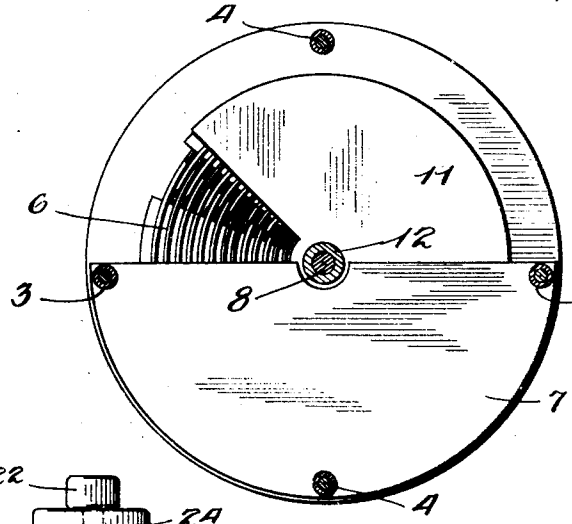


Fig. 2.

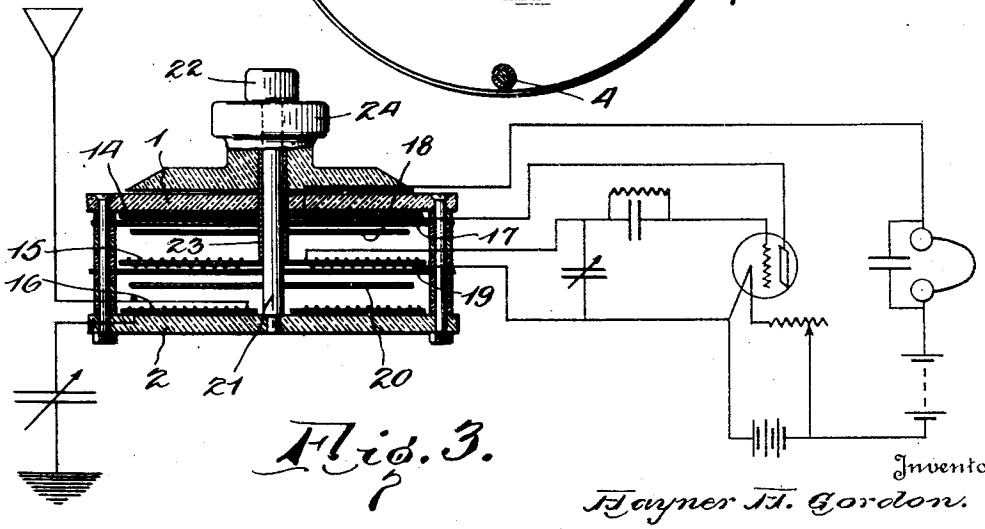


Fig. 3.

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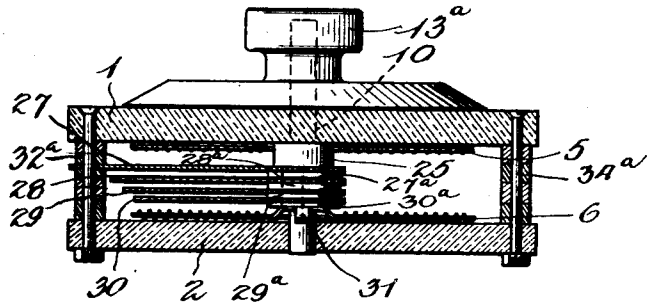


Fig. 4.

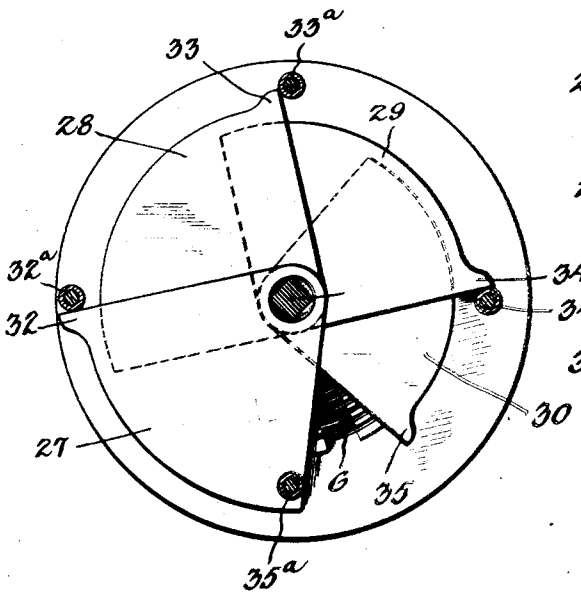


Fig. 5.

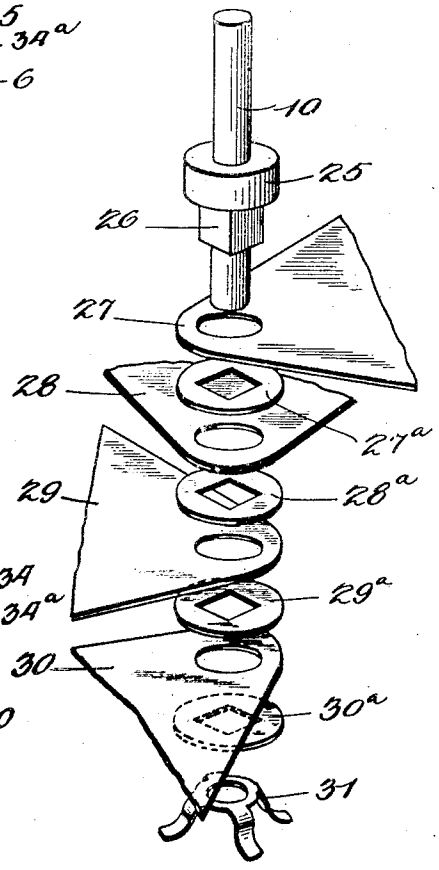


Fig. 6.

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Patented Oct. 27, 1925. 1,558,473

UNITED STATES PATENT OFFICE.

HAYNER H. GORDON, OF WASHINGTON, DISTRICT OF COLUMBIA.

VARIOCOUPLER FOR RADIO TELEGRAPHY AND TELEPHONY.

Application filed October 22, 1923. Serial No. 670,212.

To all whom it may concern:

Be it known that I, HAYNER H. GORDON, a citizen of the United States residing at Washington in the District of Columbia, have invented new and useful Improvements in Variocouplers for Radio Telegraphy and Telephony, of which the following is a specification.

It is an object of the present invention to provide a vario-coupler in which magnetic inter-action between the windings may be controlled without movement of the windings relative to each other.

It is a further object of the present invention to provide a vario-coupler construction in which a shield of non-magnetic material is located between the windings, which shield is movable to vary and to control the extent of interaction between the windings.

It is a still further object of the present invention to provide a vario-coupler having fixed tightly coupled windings, the interaction of the windings being regulatable by means of a copper shield.

Reference is now had to the accompanying drawings which illustrate several feasible embodiments of my invention.

Fig. 1 is a diametrical cross section of one embodiment of the present invention.

Fig. 2 is a plan view of the same with the top plate and winding removed.

Fig. 3 is a combined sectional and diagrammatic view of the standard three circuit receiver.

Fig. 4 is a diametrical cross section of another modification.

Fig. 5 is a plan view of the modification shown in Fig. 4 with the top plate and winding removed.

Fig. 6 is an enlarged dissected view showing the mounting of the shielding plates on the shaft.

The specific embodiment shown in Figs. 1 and 2 of the drawings comprises upper and lower end plates 1 and 2, composed of bakelite or other similar insulating material. These plates are spaced parallel to each other by a plurality of spacing washers 3, 3, mounted upon a plurality of screws 4 which serve to bolt the plates 1 and 2 together.

Secured to or mounted upon the lower surface of plate 1 is a flat inductive winding 5. This winding as shown is of the "spider web" type although any flat winding either of single or multiple layers may be used. Mounted upon the upper surface of the lower plate 2 is a second coil similar in structure to the first. These coils being located parallel to each other and separated a relatively short distance have a strong magnetic effect on each other and are in the electrical relationship to each other technically known as tightly coupled.

A semi-circular shield plate of copper or similar non- or diamagnetic material 7 is fixedly mounted upon the supporting screws or posts 4, this plate being spaced parallel to and located intermediate the windings 5 and 6 by means of the suitable disposition of the spacing washers 3.

A shaft 8 is mounted in bearings 9 and 10 in the upper and lower plates 1 and 2, so that the axis of the shaft is perpendicular to the plane of the plates and the windings carried by them. Fixed to the shaft and located between the shield plate 7 and the lower coil 6 is a second semi-circular shield plate 11 made of the same material as plate 7. The position of this plate is located by means of spacing washers or collars 12 and 13.

An insulating knob 13^a of conventional form is used to rotate the shaft 8 and thereby to cause the plate 11 to rotate more or less from a position opposite the fixed plate 7 and thereby to exercise a variable control on the magnetic or electro-static interaction between the windings 5 and 6. It will be seen that the position of the rotating plate 11 may be altered from a position in which the windings are fully shielded from each other, to a position in which interaction or coupling exists between one half of each coil. The coupling effect between the windings 5 and 6 may therefore be varied to a considerable extent without moving the windings relatively to each other in the simple and compact structure just described. The windings 5 and 6 are respectively connected to any two circuits the coupling between which it is desired to control. If desired, however, windings 5 and 6 may be connected in series and the device thereupon becomes a variometer capable of regulating the self inductance of a circuit.

In Fig. 3 is shown a further modification of the present invention in which three coils 14, 15 and 16 are mounted between and parallel to end plates 1 and 2. Coil 14 is shielded from coil 15 by the stationary

shield plate 17 and movable shield plate 18 and coil 15 is shielded from coil 16 by stationary shield plate 19 and movable shield plate 20. The shield plate 20 is controlled by means of shaft 21 and knob 22, and movable shield plate 18 is carried on a bushing 20 and is controlled by the knob 24.

In the embodiment disclosed in this figure, winding 16 is connected in the antenna circuit, winding 15 is connected in the grid circuit, and winding 14 is connected in the plate circuit. Knob 24 together with the movable shield plate 20 therefore controls the coupling between the antenna and the grid circuits, and knob 22, operating plate 18 controls the effect of the plate circuit upon the grid circuit through coils 14 and 15 and therefore controls and regulates the regenerative effect in the circuit disclosed.

The modification shown in Figs. 4, 5 and 6 relates to a form of the present invention in which it is desired to reduce the shielding effect between the windings to a minimum. The structure comprises parallel end plates 1 and 2 carrying windings 5 and 6 in the manner previously described. A controlling shaft 10 is mounted concentric and perpendicular to the plane of windings 5 and 6, the shaft being controlled by a knob 13^a. Constructed integrally with the shaft 10 is a cylindrical collar 25 having a squared dependent portion 26. Four shielding plates 27, 28, 29 and 30 of non- or diamagnetic material are shown. These plates are each adapted to cover an arc of approximately 100° so as to permit of overlap, and each plate is provided with a circular opening to fit over the squared shank portion 26 of the collar 25 and to be free to rotate relative thereto. Located between each plate are friction washers 27^a, 28^a, 29^a and 30^a provided with square openings, which fit upon the squared shank 26 and thereby are caused to rotate with the same. The assemblage of plates and washers upon the shank 26 is held in tight yielding engagement by means of a spring washer 31 which presses the assembly against the collar 25. The collar 25 provides a suitable spacing means between the upper shield plate 27 and the upper plate 1 when the device is assembled. As shown in Fig. 5 the shield plates 27, 28, 29 and 30 are provided with outwardly extending projections, 32, 33, 34 and 35 respectively. These projections which vary in length engage respectively with the mounting columns 32^a, 33^a, 34^a and 35^a, respectively, which are not concentric with shaft 10 but which are spirally arranged with respect to the axis of this shaft, and at successively diminished distances therefrom. Plate 27 is fixed to mounting pillar 35^a and is therefore stationary.

When the shaft 10 is rotated by the knob 14 it tends to rotate plates 28, 29 and 30 with it by virtue of their frictional engagement with washers 27^a, 28^a, 29^a and 30^a. When the projection 33 of plate 28 comes in contact with pillar 33^a, it is constrained from further rotation. Plates 29 and 30 continue to rotate however until projection 34 contacts with supporting pillar 34^a, when further rotation of plate 29 is prevented. Plate 30 however continues to rotate until 35 contacts with supporting pillar 35^a, when the shielding action of the plates is complete. Upon reverse rotation of shaft 10 the plates rotate into position behind plate 27, their rear edges contacting with pillar 35^a in such manner as to prevent further backward rotation of plates, and approximately 270° or three-fourths of the windings are exposed to each other.

It is of course obvious that any number of shielding plates may be utilized in this modification.

Still further modification of the present invention may be contemplated within the scope of the appended claims.

What I claim is:

1. In combination, two or more circuits each of which includes an inductance, said inductances being arranged for maximum coupling effect each with the other, diamagnetic members interposed between adjacent inductances partially reducing the interaction therebetween and diamagnetic members movably interposed between adjacent inductances to further modify the degree of interaction between adjacent inductances.

2. In combination, two or more circuits each of which includes an inductance, said inductances being arranged for maximum coupling effect each with the other, diamagnetic members interposed between adjacent inductances partially reducing the interaction therebetween, said members being relatively offset, and diamagnetic shields movably interposed between adjacent inductances to further modify the degree of interaction between adjacent inductances.

3. In combination, three circuits, an inductance including in each circuit, said inductances being arranged for maximum coupling effect between the adjacent inductances, diamagnetic members interposed between adjacent inductances partially reducing the interaction therebetween and diamagnetic members movably interposed between adjacent inductances to further modify the degree of interaction between adjacent inductances.

4. In a vario-coupler, the combination of a fixed winding, a second fixed winding mounted adjacent said first winding and a diamagnetic shield located between said windings comprising a fixed element and an adjustable element.

5. In a vario-coupler, the combination of a fixed flat winding, a second fixed flat wind-

ing mounted parallel and adjacent to said first winding, a diamagnetic segmental member fixedly located between said windings and adapted to shield a portion of them from each other and a second diamagnetic segmental member movable with respect to said first mentioned segmental member.

6. In a vario-coupler, the combination of a fixed flat winding, a second fixed flat winding mounted parallel and adjacent to said first winding, a diamagnetic plate member fixedly located adjacent said windings with its plane parallel to the plane of the windings and adapted to alter the natural inductance of the windings by virtue of its relationship thereto and a second diamagnetic plate member mounted adjacent said coils with its plane parallel to the plane of the coils and means for moving said second plate member with respect to said first mentioned plate member.

In testimony whereof, I have hereunto affixed my signature.

HAYNER H. GORDON.