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2,307,447

MAGNETIC COUPLING CONTROL

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Fig. 1.

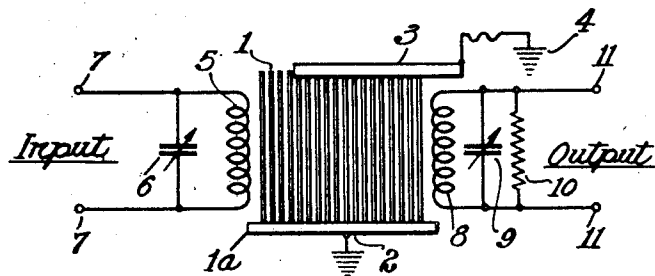


Fig. 2.

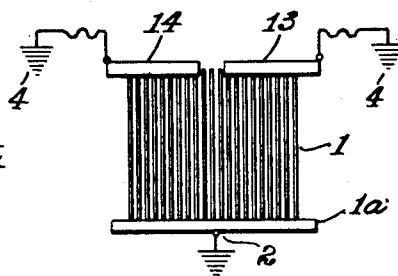


Fig. 3.

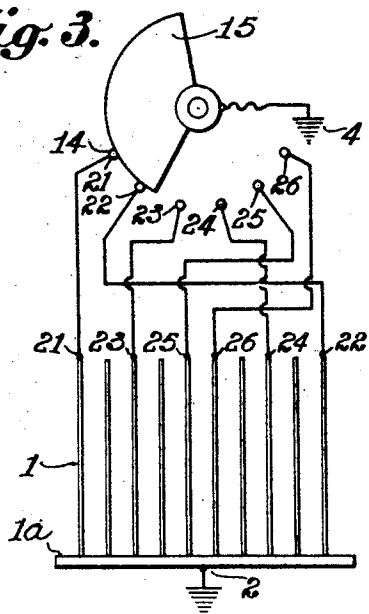


Fig. 4.

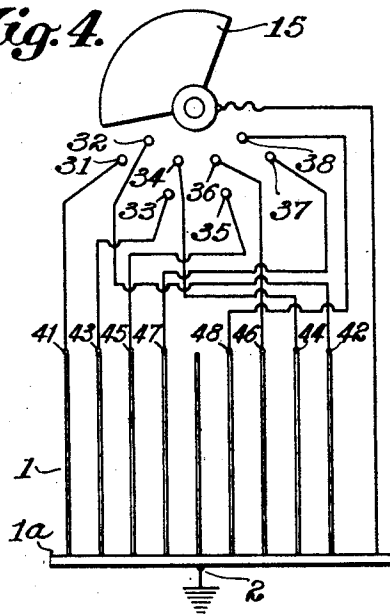
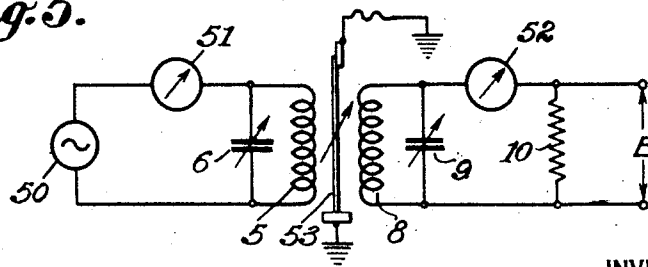


Fig. 5.



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MAGNETIC COUPLING CONTROL

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9 Claims. (Cl. 171-242)

This invention relates to a magnetic coupling control which is especially adapted for radio apparatus.

An object of this invention is to simplify and improve magnetic coupling controls in radio receiving and transmitting circuits generally.

Another object of this invention is to provide an accurate, simple and inexpensive arrangement of magnetic coupling control of an input and output coil.

Variable coupling between tuned radio circuits is usually attained by making one of the coils movable with respect to the other. This type of variable coupling is generally very rough and only approximate in variable coupling response and therefore any given degree of coupling is not readily or accurately duplicated. By my invention, a more accurate control of the amount of magnetic flux linkage between two coils is provided so that some sort of value can be placed on the degree of coupling between an input and an output circuit. Briefly, the preferred means for accomplishing such control is to place an electrostatic shield or Faraday screen between the coils, the ungrounded side of the shield being arranged so that various portions of it can be successively grounded. Such an arrangement would provide a variable electro-magnetic screen between two coils which would effectively control the magnetic coupling therebetween.

This invention will best be understood by referring to the accompanying drawing, in which:

Fig. 1 shows one arrangement of this invention and its associated circuit;

Fig. 2 shows another arrangement of this invention and differs from Fig. 1 in that there are provided two sliding bars in place of the single bar of Fig. 1;

Fig. 3 is an arrangement employing a rotary type fan switch for connecting contacts which vary the magnetic coupling through the static shield;

Fig. 4 is another arrangement employing a rotary fan switch and is generally similar to that of Fig. 3, except that the contacts are arranged in pairs so that certain elements may be short-circuited simultaneously; and

Fig. 5 is a circuit arrangement of an oscillation generator with a magnetic coupling control device of this invention acting as an attenuator.

Referring now in detail to the drawing, in Fig. 1, there is shown a variable magnetic shield of this invention and comprises a plurality of parallel arranged screen elements 1, which generally comprises a plurality of wires or rod-like members

placed in a row and are usually insulated wires of small diameter arranged in close proximity to each other. In some cases, larger wires or metallic bars may be used with greater spacing. Also, one, two, three or more parallel arranged rows may be used, depending on the degree of shielding required. The screen elements are electrically connected together by a metallic strip 1a located at the bottom portion thereof at a point 2, which is maintained at ground potential. A movable sliding bar 3 is arranged at the upper portion of the screen 1, and is provided with any suitable means for moving it along and contacting the screen elements by a wiping contact arrangement so as to progressively electrically connect the parallel arranged elements together. The movable sliding bar 3 is electrically connected to ground at a point 4. On one side of the shield is located an input coil 5 which is tuned by variable condenser 6, which is connected in parallel to input terminals 7. An output coil 8 is located on the other side of the shield and includes a variable condenser 9 and resistance 10, both of which are connected in parallel to output terminals 11. In the arrangement shown, the shield is drawn at right angles to its true position between the two coils 5 and 8, merely to make the explanation of its operation simpler. In its actual use, the plane of the static shield would be at right angles to the plane passing through the axes of the two coils. In the arrangement of this device, the ungrounded or upper ends of the screen elements are arranged so that the grounded sliding bar 3 successively makes contact with and grounds the screen elements as the bar is moved from right to left, as in the drawing. It will be noted that with one side of the screen grounded and the other side free, static coupling between the coils is eliminated. By grounding the free side, magnetic coupling is also eliminated. In the position shown, the greater portion of the screen is grounded. Any coupling between coils 5 and 8 must necessarily be through the ungrounded portion of the screen. It will be evident that when the slider 3 is in such a position as to ground all the screen elements, there can be substantially no coupling between the two circuits. It may be pointed out that any electrostatic coupling which might have existed between the coils has already been eliminated by the presence of the shield. Therefore, any possible coupling from one circuit to the other is substantially eliminated.

In the arrangement shown in Fig. 2, the static shield comprising parallel arranged metal mem-

bers 1 is provided with two movable grounding strips 13 and 14, which are arranged to move toward and away from each other, thus grounding the outer screen elements first and the center ones last. Such an arrangement gives a more uniform control of the magnetic field.

The arrangement shown in Fig. 3 is generally similar to that of Figs. 1 and 2, except that the elements are shown spaced apart at a greater distance in order to show the connections to contacts 14, which are arranged along the circumference of a circle and are short-circuited by means of a rotary type fan switch 15. The fan switch 15 successively shorts the switch points 14, numbered from 21 to 26. The switch contacts are connected so that as the switch blade 15 is rotated, elements at opposite ends of the screen 1 are shorted first, the innermost portions being reached last. The resultant action is that of a gradual narrowing of the screen opening from the outside to the center. It is seen that it is not necessary to ground each individual screen member. For example, they may be grounded in groups at a time, skipping none. They may be arranged so that only every other one is connected to the switch, or they may be connected so that only certain plates are grounded. By choosing the proper sequence of grounding of the elements, it will be possible to obtain a linear or logarithmic variation of the coupling.

The arrangement shown by Fig. 4 is generally similar to that of Fig. 3, except that the contacts are arranged in pairs, extending radially from the center of the rotational axis of the rotary fan switch 15, so that certain elements or groups of plate elements may be shorted simultaneously. As shown in this particular arrangement, the corresponding elements located at opposite ends of the static shield are grounded at the same time. This arrangement provides a more symmetrical gradation of the shield adjustment. In the diagram shown, contact points 31 and 32 connect to elements 41 and 42, respectively. Points 33 and 34 connect to elements 43 and 44, and so on.

The circuit diagram of Fig. 5 shows how the variable magnetic screen or shield of this invention may be used as an attenuator for an oscillation generator circuit. By setting the input from the oscillation generator 50 to give a certain deflection on meter 51, the output voltage E may be calibrated for various adjustments of the variable screen 53. Then, if the current in the input circuit is kept constant, the output calibration will be accurate. As mentioned above, by properly designing the screen and its sequence of grounding the parallel arranged metallic elements, it will be possible to accurately vary the output voltage E according to a desired law.

Since only a few specific embodiments of this invention are herein shown, it is to be distinctly understood that it should not be limited precisely thereto.

What is claimed is:

1. A magnetic coupling device comprising a pair of coupling coils, a static shield member interposed between said coils, said member comprising a plurality of parallel extending conductors electrically grounded at one end and normally electrically dissociated at the other end, and means contacting a variable number of said conductors at said other end for varying the magnetic coupling between said coils.

2. A magnetic coupling device comprising a

pair of coupling coils, a static shield member including a plurality of parallel-disposed linear metallic elements interposed between said coils, said elements having corresponding ends electrically bonded together and their other ends normally electrically free, and circuit closing means for contacting a variable number of said metallic elements to vary the degree of coupling between said coils.

3. A magnetic coupling device comprising a pair of coupling coils, a static shield member including a plurality of parallel arranged metallic filaments interposed between said coils, said filaments being shunt connected at one end and electrically free at the other end, and means contacting a variable number of said metallic filaments at said other end to vary the coupling between said coils.

4. A magnetic coupling shield device comprising a pair of coupling coils, a static shield member including a plurality of parallel arranged metallic bars interposed between said coils and normally grounded at one end only, and at least one grounded sliding contact member arranged to interconnect corresponding ends of a variable number of said bars to vary the magnetic coupling between said coils.

5. A magnetic coupling device comprising a pair of coupling coils, a static shield having a plurality of linear metallic elements interposed between said coils and parallel arranged with respect to each other, a plurality of contact members arranged in pairs electrically connected to said elements, and means including a fan-shaped grounding switch arranged to make progressive connection to different pairs of said contacts for varying the magnetic coupling between said coils.

6. A magnetic coupling device comprising a pair of coupling coils, a static shield member including a plurality of metallic elements interposed between said coils, and means including a pair of sliding contact members arranged to successively short-circuit said metallic elements for varying the coupling between said coils.

7. A magnetic coupling device comprising an electrostatic shield having a plurality of parallel-disposed conductors electrically interconnected at one end and electrically free at the other end, a pair of inductively coupled circuits, said electrostatic shield being interposed between said coupled circuits, and means for electrically interconnecting a selected number of said conductors at their free end and back-connecting the same to said one end, thereby to vary the amount of magnetic flux passing therethrough.

8. A magnetic coupling device comprising a pair of coupling coils, a static shield member including a plurality of insulated wires arranged in a row, said shield member being interposed between said coils, and means for progressively contacting a selected number of said metallic elements to vary the degree of coupling between said coils.

9. A magnetic coupling device comprising a pair of coupling coils, a static shield having a plurality of linear metallic members disposed in a plane of separation between said coils and parallel arranged with respect to each other, a connection to ground from corresponding ends of said members, and a fan shaped switch arranged to put ground potential on the ends of selected ones of said members thereby to vary the magnetic coupling between said coils.

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