June 25, 1946. B. M. CHARCHIAN 2,402,599

INDUCTIVE COUPLING

Filed Oct. 20, 1942

Fig. 1.

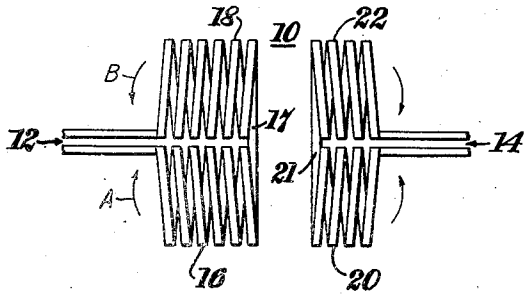


Fig. 2.

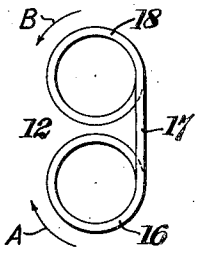
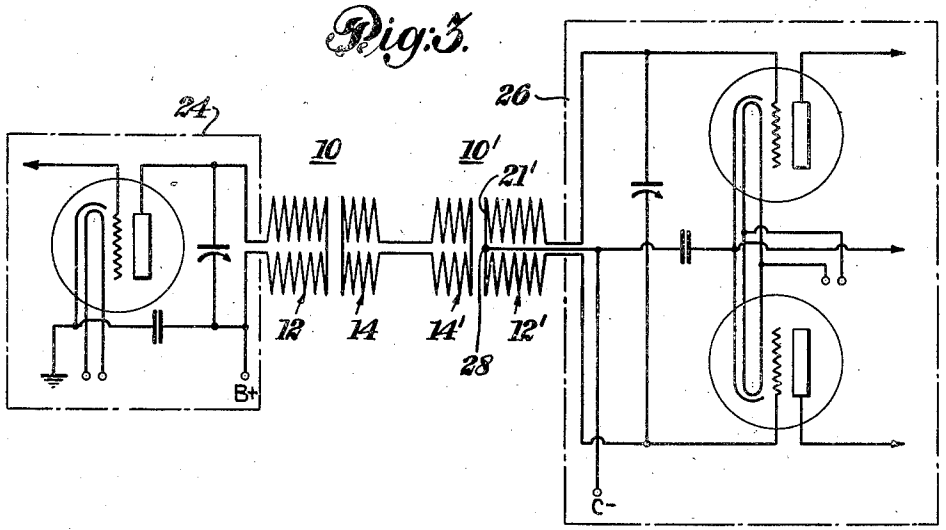


Fig. 3.



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INDUCTIVE COUPLING

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2 Claims. (Cl. 175—359)

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This invention relates to improvements in inductive couplings, and more particularly to such couplings for use in connection with medium high frequency circuits.

In the case of transformers or inductive couplings for use in circuits carrying relatively low frequency currents, the problem of unbalance due to the coupling is relatively unimportant as at such low frequencies the difference of a turn one way or another makes very little difference in the characteristic of the coupling and undesirable electrostatic coupling can be readily avoided by a suitable shield. In the case of the coupling of circuits carrying ultra-high frequencies, on the other hand, the question of the balance of the coupling is also relatively unimportant, as, in most cases, the coupling can readily be effected by means of a simple single link. In coupling circuits carrying medium high frequency currents, however, transformers requiring several turns are needed but, in such circuits, the difference of a half or quarter turn in a winding is still very important with respect to the question of balance and, moreover, the balance can also be upset by the electrostatic coupling between the coils and between the individual turns of each coil.

It is the primary object of the present invention to provide an inductive coupling, particularly for use at medium high frequencies, which will be perfectly balanced, and in which electrostatic coupling is substantially neutralized without the use of any shield.

The invention is described in more detail below, and as illustrated by way of example in the accompanying drawing in which:

Fig. 1 is a top plan view of a coupling formed in accordance with the present invention;

Fig. 2 is an end view of one of the coupling coils illustrated in Fig. 1;

Fig. 3 is a circuit diagram illustrating, by way of example, the manner in which my new coupling may be used.

In Fig. 1 the coupling as a whole is generally indicated at 10, and will be seen to comprise two windings, one of which may be the primary 12 and the other the secondary 14. The primary winding 12 as shown in Figs. 1 and 2 is formed of two identical cylindrical windings 16, 18, wound in opposite directions, connected at one end by a common lead 17, and preferably positioned exactly parallel to one another. The secondary winding 14 is formed identically with the primary winding 12 consisting of a pair of parallel cylindrical windings 20, 22, interconnected at one end by a common lead 21. The coils 16 and 18 are wound in opposite directions as indicated by the arrows A and B, and this opposite winding is also used in the construction of the secondary 14. The primary and secondary are juxtaposed so that, for example, the coils 18 and 22 are coaxial and the coils 16 and 20 are also coaxial. The spacing between the primary and secondary will depend, of course, upon the type of coupling desired, and the number of turns in the primary and secondary windings can be chosen as desired. In any event, however, the number of turns in the coil 16 must be equal to the number of turns in the coil 18, and likewise the number of turns in the coils 20 and 22 must be the same. In order that all electrostatic coupling be completely neutralized, the parallel coils of each winding should be spaced together as closely as possible without touching.

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The coupling described above can be used between balanced or unbalanced circuits and in all cases provides an arrangement in which perfectly balanced coupling is obtained and electrostatic-coupling is substantially neutralized. In using this coupling between an unbalanced circuit and a balanced circuit, it is unnecessary to provide a mid-point tap such as is now common.

An example of the use of my coupling in connecting an unbalanced circuit to a push-pull circuit is illustrated in Fig. 3 in which, moreover, the use of my coupling as a link coupling is also illustrated. In this figure the balanced couplings 10 and 10' are used to interconnect a driver stage 24 to a push-pull amplifier 26. As a link coupling, two of my improved couplings are used and in this case the winding 14 of the coupling 10 will be connected to the winding 14' of the coupling 10'. The winding 12' will lead to the grids of the amplifier stage 26 and the mid-tap 23 and the interconnecting lead 21' will be connected to the push-pull cathodes. A completely balanced coupling is obtained by means of this arrangement, despite the fact that the driver stage 24 is unbalanced and the amplifier stage 26 is balanced. It will, of course, be understood that instead of the link coupling arrangement illustrated in Fig. 3, a suitable direct coupling using only one of my couplings is appropriate.

In certain instances, it may be advantageous to design the windings of my coupling to have a length substantially equal to one-quarter of the wavelength of the resonant frequency to which the circuit is tuned. In this case each winding consisting of two equal parallel coils may be

considered as a resonant line folded back upon itself.

While I have illustrated a specific form of coupling and have shown a specific circuit embodying the same, it is to be understood that these illustrations have been given merely by way of example, and that the invention is not to be considered as limited thereto.

What I claim is:

1. A coupling comprising a primary winding consisting of a pair of parallel single layer cylindrical coils of equal turns arranged side by side, wound in opposite directions and connected together at one end, and a secondary winding consisting of a pair of parallel single layer cylindrical coils of equal turns arranged side by side, wound in opposite directions and connected together at one end, the connecting ends of said primary and secondary windings being juxtaposed face-to-face so that each coil of the primary is coaxial with the corresponding coil of the secondary and the conductive connections between the coils of each winding are disposed in adjacent alignment with one another on the same side of the plane of the coil axes.

2. A coupling according to claim 1, in which the parallel cylindrical coils of each pair are substantially tangent to one another.

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