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HIGH FREQUENCY COUPLING ELEMENT

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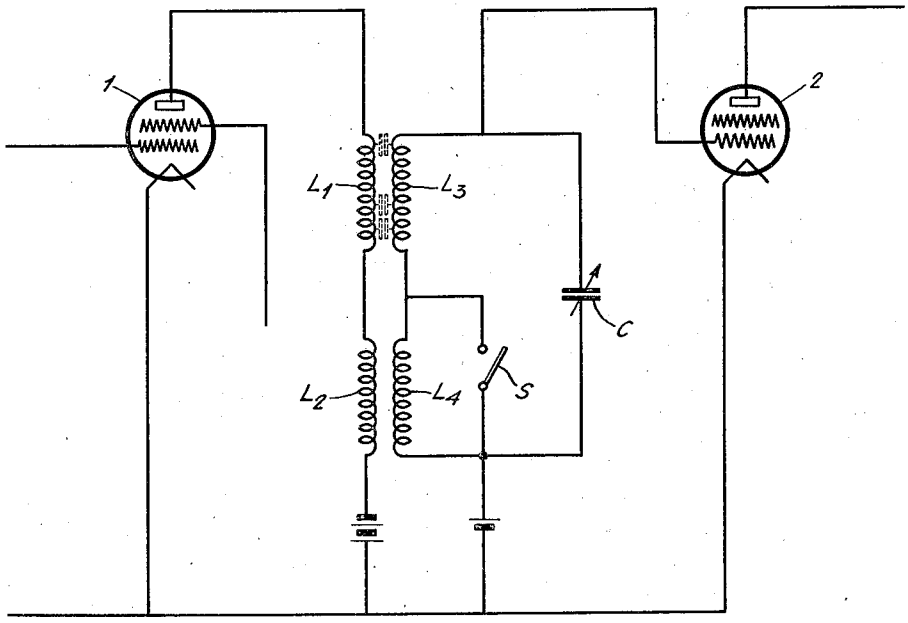

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HIGH FREQUENCY COUPLING ELEMENT

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3 Claims. (Cl. 179—171)

This invention relates to a high frequency coupling element which may serve, for instance, for mutually coupling two thermionic discharge tubes in radio receiving sets.

In radio receiving sets in which high frequency transformers are used between the antenna and a high frequency amplifying tube or between two high frequency amplifying tubes or again between a high frequency amplifying tube and the detector, the drawback occurs that if such a set must be constructed for receiving two or more wave length ranges a large number of switches is required which on changing over from a longer wave range to a shorter wave range partly short-circuits both the primary and the secondary winding of each high frequency transformer.

In order that a smaller number of switches shall be sufficient it has already been proposed to provide each high frequency transformer with a single short-circuit switch by which either, part of the primary only or part of the secondary winding only is short-circuited. When by using definite winding methods, the coupling between the primary and the secondary winding of such a high frequency transformer substantially corresponds to the maximum possible coupling i. e. such that with an equal number of primary and secondary windings the coupling factor is about 1, then by short-circuiting part of one of the windings the corresponding part of the other winding will automatically also be short-circuited as is well known. In this case, however, it is not taken into account that the other winding is possessed of self induction and in addition of ohmic resistance which ohmic resistance is not short-circuited. This resistance causes losses and will consequently affect the selectively of the arrangement if one of the windings of the high frequency transformer is tuned by means of a condenser to the frequency to be received.

The invention provides means for avoiding said drawback. According to the invention this is ensured by providing extra turns on one of the windings which, upon short-circuiting part of one coil induces a voltage in the part of the other coil coupled therewith, said voltage having such a value and phase that no current flows in that part due to the fact that the E. M. F. across the primary circuit by virtue of the connection of the primary circuit across the source is opposed by the extra windings.

The invention will be more clearly understood by reference to the accompanying drawing representing, by way of example, two high frequency amplifying tubes 1 and 2 coupled together by a coupling element according to the invention. This coupling element consists of two very closely mutually coupled coils L_1+L_2 and L_3+L_4. The last mentioned coil may be tuned by means of condenser C connected in parallel therewith, to the frequency of the voltages to be amplified. Furthermore, a switch S is provided which is opened, upon tuning to a frequency lying in the long wave range and is closed, on tuning to a frequency of the short wave range, so that either the whole of the coil L_3+L_4 or only the coil L_3 is inserted in the tuned circuit. The very close coupling between the coils L_1 and L_3 and between the coils L_2 and L_4 may be ensured, for instance, by winding the coupling element with stranded-wire and by using part of the strands for the coils L_1 and L_2, the coils L_3 and L_4 being constituted by the remaining strands it being understood that the various strands making up the stranded wire are insulated. If the coil L_4 upon tuning to a frequency within the short wave range, is short-circuited, it appears that also the coil L_2 coupled with L_4 has practically no longer any self induction, which will be appreciated when considering that due to the close coupling the coil L_2 has practically no leakage self induction. The coil L_2 however, is possessed of resistance which may be so large that the losses highly increase upon tuning to shorter waves. If it is desired to avoid these losses care must be taken that the current traversing L_1 does not flow through L_2 but is compelled to flow through the capacity provided between the coils L_1 and L_3, through the switch S to the cathode of the tube 1. According to the invention this is ensured when switch S is closed by inducing a voltage in the circuit consisting of L_3—S—the connection between the batteries —L_2L_1, for instance, by giving the coil L_3 one or more turns more than the coil L_1. Thus a certain potential difference is set up throughout the length of both coils owing to which a current flows in said circuit. By making this current inverse and equal to the anode current caused by the tube 1 through the coil L_2, it can be achieved that the current in L_2 becomes zero, so that no losses occur any longer in the coil L_2. The exact number of turns for the compensating winding depends on the value of the anode-cathode capacity of the amplifying tube 1, on the capacity between the windings and on the ratio of transformation so that it should be chosen accordingly.

What we claim is:

1. A high frequency repeating system comprising a pair of electronic tubes, an output circuit for one of the tubes, a pair of series connected coils in

said output circuit, an input circuit for the second tube, a pair of series connected coils in said input circuit corresponding to said first pair of coils, the coils in said input circuit being closely coupled to the corresponding coils in said output circuit, a switch for short circuiting one of the coils in the input circuit, capacity coupling between the other coil in the input circuit and its corresponding coil in the output circuit, one of the last two named coils having a greater number of windings than the other thereof for causing high frequency energy in the output circuit to be transferred to the input circuit through said capacity coupling and to flow through said switch instead of through the coil in said output circuit which is coupled to the coil in the input circuit short circuited by the switch.

2. In a coupling arrangement for transferring high frequency energy from a source to a multi-range tunable circuit, an inductive element connected across the source, said element comprising a plurality of coil sections, said tunable circuit including an inductive element made up of a plurality of coil sections corresponding to the coil sections of the first inductive element, the corresponding coil sections of the two inductive elements being closely coupled, capacity coupling between said corresponding coil sections, means for connecting one end of each of said inductive elements together, operable means for short-circuiting one of the coil sections of the second inductive device to adapt said tunable circuit to tune to a different frequency range, one of the other of said coil sections of the second inductive element being provided with a greater number of turns than the corresponding coil section of the first inductive element to thereby provide a potential difference between said two last named coil sections of such sense as to oppose the flow of high frequency current through the first inductive element when said short circuiting means is operated to short circuit the coil section.

3. In a signalling circuit, a source of high frequency voltage including a first electronic tube provided with an anode and a cathode, a utilizing circuit including a second electronic tube, input terminals for said utilizing circuit, a coupling system provided with segregated alternating current and direct current paths, said coupling system including a coil, a connection between one terminal of the coil and the anode, a circuit connecting the other terminal of the coil to the cathode of the first tube, and a second coil connected across the input terminals, said second coil being provided with a shunt tuning condenser, capacity between said first and second coils through which alternating current is transferred from the source to the utilizing circuit, mutual inductance between said coils of such polarity and magnitude that current flowing in the second coil induces a voltage in the first coil which is substantially equal and opposite to the voltage impressed across the first coil by virtue of its connection across the anode and cathode of said first tube whereby alternating current is prevented from flowing in the circuit connecting the first coil to the cathode of the first tube.

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