Jan. 10, 1956 L. BORG 2,730,670

MEANS FOR PRODUCING LOW-FREQUENCY ELECTRICAL OSCILLATIONS

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Fig. 1.

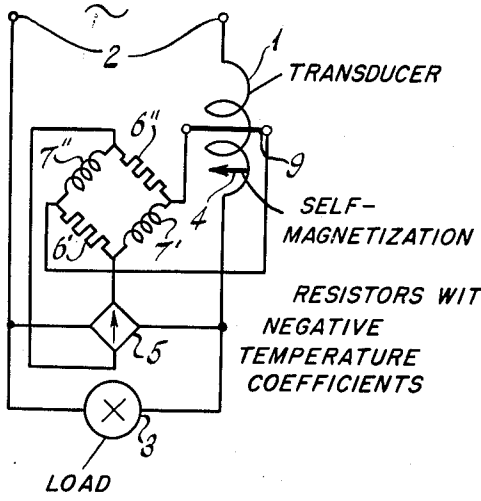


Fig. 2.

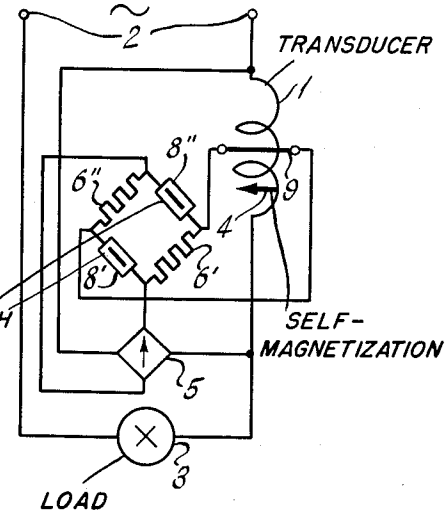


Fig. 3.

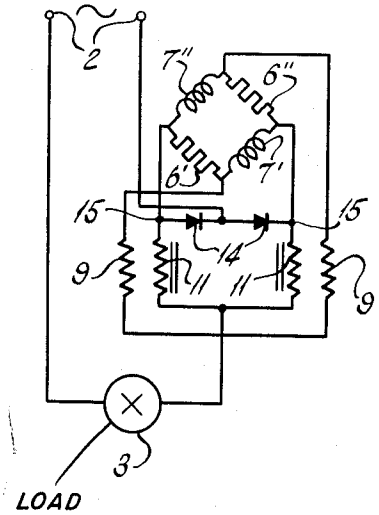
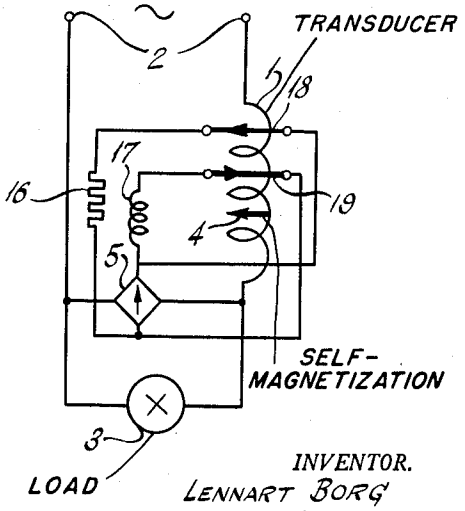


Fig. 4.



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MEANS FOR PRODUCING LOW-FREQUENCY ELECTRICAL OSCILLATIONS

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Claims priority, application Sweden November 14, 1949

6 Claims. (Cl. 321—68)

It is known to produce low-frequency electrical oscillations by means of a transductor which is magnetised from a rectifier controlled by the transductor through a circuit containing impedance elements of such a character that independent electrical oscillations are produced in the circuit which alternately magnetise and demagnetise the transductor. It has now been found that the same result may be achieved by having the transductor magnetised and demagnetised by currents passing through circuits the impedances of which are differently time-dependent. In that case the impedances may frequently be of a simpler character than in the known connections. Thus it is possible, for instance, to dispense with capacitors which are expensive or which necessitate windings with many turns on the transductor and in that way make it more expensive.

The different circuits may be entirely separated from each other, so that they include different D. C. windings on the transductor, opposing each other, or they may only be partly separated, so that one transductor is common to both of them. The latter connection usually forms a simplification, especially if the said circuits form part of a so-called bridge-connection.

Four forms of the inventions, applied to selfmagnetised transductors, are schematically shown in the Figs. 1–4 of the accompanying drawing.

In Fig. 1 a transductor **1** and a load **3** are connected in series between A. C. terminals **2**, said load consisting for instance of one or more lamps. The transductor has a conventionally shown self-magnetisation **4**, for instance a so-called internal self-magnetisation, by means of valve elements connected in series with the transductor elements, which self-magnetisation may possibly be increased by some additional winding turns which may be traversed for instance by a pulsating current taken from a half cycle of the A. C. current traversing the main windings other than that traversing the main winding of the transductor element (substantially as described in the British Patent 589,341). A rectifier **5** is connected in parallel to the load. The D. C. terminals of the said rectifier feed two opposite corners of a bridge-connection, including resistors **6′**, **6″** in two opposite branches, and reactors **7′**, **7″** in the remaining opposite branches. The reactors may be provided with a common iron core. A winding **9** of the transductor is connected across the two remaining corners of the bridge.

The described device operates in the following manner. The self-magnetisation alone only permits a small current to pass through the transductor which current is insufficient to light the lamp **3**. When the device is connected to the A. C. terminals a substantial current at the first instant only traverses the resistors **6′**, **6″** while the current through the reactors **7′**, **7″** is immaterial. The external current from the bridge will then pass from its left corner to its right corner traversing the transductor winding **9** in the same direction as the self-magnetisation **4**, i. e. the transductor will be magnetised so as to supply full current to the lamp **3**. The current in the reactors **7′**, **7″** will, however, gradually be increased and when it attains

the same value as the current through the resistors **6′**, **6″**, the transductor will be demagnetised again, and the lamp will be extinguished. The current will then again be decreased in the reactors **7′**, **7″**, and when it is sufficiently reduced, the transductor will be magnetised again through the resistors **6′**, **6″**, and the procedure will be repeated.

Fig. 2 includes two independent modifications with respect to Fig. 1. First, the reactors **7′**, **7″** are replaced by resistors **8′**, **8″**, having a negative temperature coefficient and a certain heat capacity, so that their resistance will be reduced only after a certain time. They operate in a manner substantially analogous to that of reactors. Secondly the rectifier **5** is connected in parallel to the transductor **1** instead of to the load **3**. This also involves the modification that the connection of the winding **9** to the bridge will be contrary to that in Fig. 1, because a low voltage across the bridge corresponds to a magnetised transductor, and for this reason an increasing current through the resistors **6′**, **6″** should have a demagnetising effect on the transductor.

Fig. 3 differs from Fig. 1 mainly in that no separate rectifier is provided, but the bridge is connected to D. C. terminals involved by the internal self-magnetisation of the transductor. Thus the transductor is, in a manner known per se, composed of two parallel connected A. C. windings **11**, each one connected in series with a rectifier element **14** which elements are so directed that one half cycle of the A. C. current traverses each winding. Between the rectifier elements and the windings, D. C. terminals **15** are obtained, and across these terminals the bridge consisting of impedances **6′**, **6″**, **7′**, **7″** is connected. The current traversing the bridge which forms a shunt to the D. C. circuit through the windings **11**, will be high when the transductor has a high magnetisation, and for that reason the winding **9** should be connected to the bridge analogously to Fig. 1, i. e. so that the current through the resistors **6′**, **6″** will operate in the same sense as the self-magnetisation.

If the transductor which is connected in series with the load, is provided with a so-called internal self-magnetisation, and with an additional self-magnetisation only one more winding is required on the transductor for causing oscillations. Said winding may be fed from a rectifier connected in parallel to the load via a reactor. The winding fed through an ohmic circuit will then be substituted by the additional self-magnetisation which is included in an ohmic circuit fed by a rectifier.

Fig. 4, finally, shows the modification with respect to Fig. 1, that the magnetisation winding **9** connected in a bridge is replaced by two magnetisation windings **18**, **19**, opposing each other. The winding **18** acting in the same direction as the self-magnetisation winding **4** is connected in series with a resistor **16**, and the opposing one in series with a reactor **17**. The mode of operation will be analogous to that described in connection with Fig. 1.

If, according to Fig. 4, the winding **18**, connected in series with the resistor, is especially amply dimensioned it is possible to obtain a more than 100% self-magnetisation, i. e. a self-magnetisation in which the D. C. ampere-turns are equal to the A. C. ampere-turns (defined in the U. S. Patent 2,455,869). Especially in that case a further self-magnetisation may be superfluous. The windings **18**, **19** may possibly be connected in series with the load, for instance if the latter is connected to the D. C. terminals of the rectifier **5**, or if the rectifier supplying current to the said windings is connected in series with the load.

Although according to the present invention it is not necessary to use a capacitor, or an element operating in analogy therewith, such elements may nevertheless be used in connection with it. In such cases they ought to

be connected analogously to the resistors represented in the figs., while the reactors or its equivalents may be replaced by resistors. The capacitors may then be so diminished that their discharging current, initially exceeds the current through the resistors which, however, will dominate as soon as the current through the capacitors has decreased.

I claim as my invention:

1. A device producing low frequency oscillations and having a source of alternating current feeding an electric circuit, comprising a transductor in said circuit, a load in circuit with said transductor exposed to said oscillations, means for the magnetization and subsequent demagnetization of the transductor including control means of the transductor, at least one rectifier connected to a voltage which is dependent on the current through the load, two current paths at least partly separated from each other and both connecting said rectifier with said control means, and impedance elements in said separated current paths, the characters of which paths are differently time-dependent, one current path affecting the magnetization and the other current path affecting the subsequent demagnetization of the transductor.

2. A device according to claim 1, in which said impedance elements are included in a bridge connection, impedance elements of the same kind being connected in opposite arms of said bridge connection, the latter being fed from the rectifier depending on the current through the load, and the bridge current being supplied to the control means of the transductor.

3. A device according to claim 2, in which two opposite arms of the bridge connection include resistors whereas the remaining opposite arms include impedance elements giving a lagging time character, in relation to the circuit including resistors, of the traversing current.

4. A device according to claim 3, in which the impedance elements giving lagging time character consist of reactors provided with a common core.

5. A device according to claim 1, in which the transductor consists of two parallel connected transductor elements, a current valve in series with each one of the alternating current windings, said valves being so directed as to form a closed direct current circuit through said windings, the impedance elements of two kinds being included in a bridge connection, impedance elements of the same kind being connected in opposite arms of said bridge connection, the latter being fed at two opposite corners from points located between said valve elements and said windings, a separate winding on each of said transductor elements, said separate windings being connected in circuit with said bridge connection at the remaining opposite corners thereof.

6. A device according to claim 1, in which said impedance elements are included in a bridge connection, impedance elements of the same kind being connected in opposite arms of said bridge connection, the latter being fed from the rectifier depending on the current through the load, and the bridge current being supplied to the control means of the transductor, two opposite arms of the bridge connection including resistors whereas the remaining opposite arms include impedance elements, giving a lagging time character, in relation to the circuit including resistors, of the traversing current, and in which a magnetization circuit of the transductor containing ohmic resistance is formed by an internal self-magnetization circuit.

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