MEANS FOR PRODUCING LOW-FREQUENCY ELECTRICAL OSCILLATIONS

Filed Nov. 7, 1950

FIG. 1.

TRANSUDER

SELF-MAGNETIZATION

RESISTORS WITH NEGATIVE TEMPERATURE COEFFICIENTS

LOAD

FIG. 2.

TRANSUDER

SELF-MAGNETIZATION

LOAD

FIG. 3.

FIG. 4.

TRANSUDER

SELF-MAGNETIZATION

LOAD

INVENTOR.

LENNART BORG

ATTORNEY.
MEANS FOR PRODUCING LOW-FREQUENCY ELECTRICAL OSCILLATIONS

Lennart Borg, Ludvika, Sweden, assignor to Allmänna Svenska Elektriska Aktiebolaget, Vasteras, Sweden, a corporation of Sweden

Application November 7, 1950, Serial No. 194,453

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 transistor which is magnetised from a rectifier controlled by the transistor 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 transistor. It has now been found that the same result may be achieved by having the transistor magnetised and demagnetised by currents passing through circuits the impedances of which are different 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 transistor 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 transistor, opposing each other, or they may only be partly separated, so that one transistor 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 transistors, are schematically shown in the Figs. 1-4 of the accompanying drawing.

In Fig. 1 a transistor 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 transistor 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 transistor elements, which self-magnetisation may possibly be increased by some additional winding turns which may be traversed from 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 transistor 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 transistor 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 transistor 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 transistor winding 9 in the same direction as the self-magnetisation 4, i.e. the transistor 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 transistor 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 transistor 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 transistor 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 transistor, and for this reason an increasing current through the resistors 6', 6'' should have a demagnetising effect on the transistor.

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 transistor. Thus the transistor 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 is connected to the D. C. circuit through the windings 11, will be high when the transistor 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 transistor 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 transistor 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 rectifier 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. amper-turns are equal to the A. C. amper-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 transducer in said circuit, a load in circuit with said transducer exposed to said oscillations, means for the magnetization and subsequent demagnetization of the transducer including control means of the transducer, 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 transducer.

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 transducer.

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 transducer consists of two parallel connected transducer 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 transducer 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 transducer, 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 transducer containing ohmic resistance is formed by an internal self-magnetization circuit.

References Cited in the file of this patent

UNITED STATES PATENTS

1,913,331 Buckingham July 22, 1929
1,979,296 Sweeney Nov. 25, 1933
2,034,787 Williams Mar. 24, 1936
2,096,867 Thompson Oct. 26, 1937
2,222,048 Stevens et al. Nov. 19, 1940
2,466,018 Ferrill Apr. 5, 1949
2,528,446 McConnell Oct. 31, 1950
2,547,027 Winkler Apr. 3, 1951
2,567,383 Krabbe et al. Sept. 11, 1951