

H03B

GENERATION OF OSCILLATIONS, DIRECTLY OR BY FREQUENCY-CHANGING, BY CIRCUITS EMPLOYING ACTIVE ELEMENTS WHICH OPERATE IN A NON-SWITCHING MANNER; GENERATION OF NOISE BY SUCH CIRCUITS (measuring, testing [G01R](#); generators adapted for electrophonic musical instruments [G10H](#); Speech synthesis [G10L](#); masers, lasers [H01S](#); dynamo-electric machines [H02K](#); power inverter circuits [H02M](#); by using pulse techniques [H03K](#); automatic control of generators [H03L](#); starting, synchronisation or stabilisation of generators where the type of generator is irrelevant or unspecified [H03L](#); generation of oscillations in plasma [H05H](#))

Definition statement

This place covers:

Generation of oscillations in a non-switching manner, i.e. by harmonic oscillators providing sinusoidal signals.

Generation without frequency changing

by means of amplification and feedback; negative resistance

by means of transit-time tubes; electron-beam tubes

by shock-exciting; Hall effect; radiation source and detectors

Generation with frequency changing

by multiplication or division of a signal

by combining unmodulated signals

Particularities of generated oscillations

Swept-over frequency range; multifrequency; multiphase; noise

Relationships with other classification places

This subclass covers circuits and methods dedicated to achieve sinusoidal oscillations by analogue means. This is to be distinguished from circuits and methods intended to generate edge shaped periodic signals (pulses, digital clocks) that are to be classified elsewhere (see references below).

This subclass covers generic oscillators that are generally applicable to any application. Oscillators adapted for a specific application or apparatus (e.g. for a specific measurement device or radar system) and which are not generally applicable should generally be classified in the groups for that application.

References

Limiting references

This place does not cover:

Generators adapted for electrophonic musical instruments	G10H
Masers, lasers	H01S
Generation of oscillations in plasma	H05H

Informative references

Attention is drawn to the following places, which may be of interest for search:

Measuring, testing	G01R
Digital function generators	G06F 1/02
Generating clock signals	G06F 1/04
Speech synthesis	G10L 13/00
Dynamo-electric machines	H02K
Power inverter circuits	H02M
Amplifiers	H03F
Resonant circuits, resonators	H03H
Tuning of resonators	H03J
Oscillators using pulse techniques	H03K
Automatic control, starting, synchronisation, or stabilisation of generators of electronic oscillations	H03L

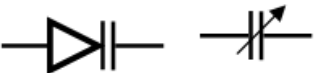
Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Elements that operate in non-switching manner	Gain element not driven to saturation; No full swing operation as in digital circuit
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Synonyms and Keywords

In patent documents, the following abbreviations are often used:

VCO	Voltage Controlled Oscillator
Q factor	Quality factor of resonator
Quadrature oscillators	Oscillators generating two signals with same frequency shifted by 90°
Varactor	Varicap diode, varactor diode, variable capacitance diode, variable reactance diode: tuning diode with variable capacitance 

H03B 1/00

Details

Definition statement

This place covers:

Details regarding the means for making the frequency variable

Structural details of power oscillators

Reduction of undesired oscillations

Relationships with other classification places

This main group is orthogonal to the other groups within [H03B](#), i.e. multiple classification in [H03B 1/00](#) and in [H03B 5/00](#) - [H03B 29/00](#) is made when appropriate.

References

Limiting references

This place does not cover:

Features of generators for heating by electromagnetic fields	H05B 6/00
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Structural details of waveguide cavity resonators	H01P 7/00
Structural details of electromechanical resonators	H03H 9/2405
Details of transmitters	H04B

H03B 1/02

Structural details of power oscillators, e.g. for heating {(construction of transmitters [H04B](#); features of generators for heating by electromagnetic fields [H05B 6/00](#))}

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Features of generators for heating by electromagnetic fields	H05B 6/00
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H03B 5/00

Generation of oscillations using amplifier with regenerative feedback from output to input ([H03B 9/00](#), [H03B 15/00](#) take precedence)

Definition statement

This place covers:

Oscillators with feedback comprising in particular

- LC tanks
- RC or RL tuned circuits
- distributed reactances (e.g. striplines, cavity resonators, magneto-sensitive resonators)
- electromechanical resonators (e.g. piezo-electric resonators, magneto-strictive resonators)

Compensation of variations in parameters affecting the output frequency or amplitude of feedback oscillators (such as power supply, load or temperature) as far as a modification of the generator itself is concerned

Starting of feedback oscillators as long as a modification of the generator itself is concerned

References

Limiting references

This place does not cover:

Generation of oscillations using transit-time effects	H03B 9/00
Generation of oscillations using galvano-magnetic devices	H03B 15/00

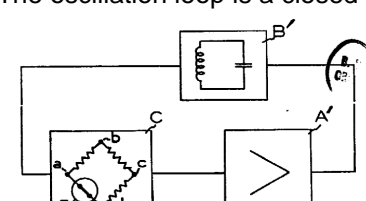
Informative references

Attention is drawn to the following places, which may be of interest for search:

Waveguide cavity resonators	H01P 7/00
Constructional details of electromechanical resonators and their holders and supports	H03H 9/05 , H03H 9/15 , H03H 9/22 , H03H 9/24 , H03H 9/25
Ring oscillators	H03K 3/0315
External temperature control	H03L 1/00
Starting of generators if no features within the oscillator are concerned	H03L 3/00
Automatic control of amplitude of generators	H03L 5/00
Automatic control of frequency of generators	H03L 7/00

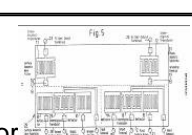
Glossary of terms

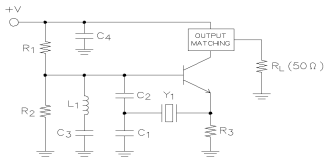
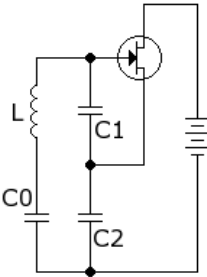
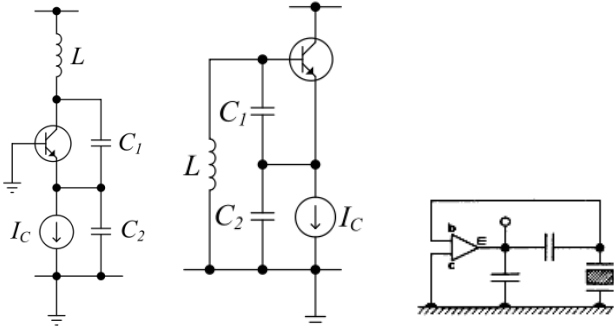
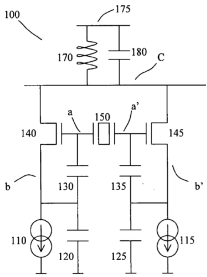
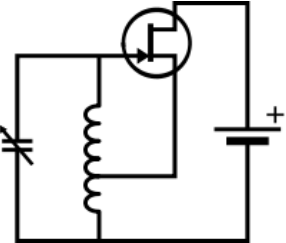
In this place, the following terms or expressions are used with the meaning indicated:

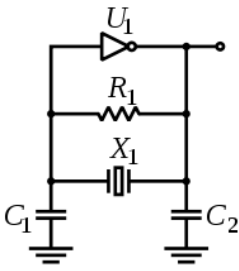
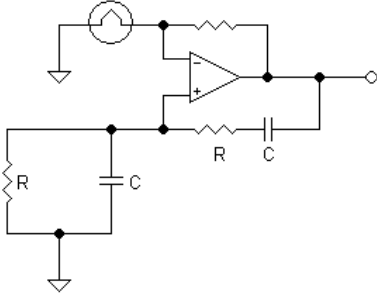
Connection via bridge circuit to closed ring	<p>The oscillation loop is a closed ring including a bridge circuit, e.g.</p>  <p>FR1488980, C Morel</p>
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Synonyms and Keywords

In patent documents, the following abbreviations are often used:

AT cut	Particular angle of crystal cut
BAW resonator	Bulk acoustic wave resonator
SAW resonator	Surface acoustic wave resonator 

<p>Butler type oscillator</p>	<p>Colpitts (or Clapp) type oscillator with a series resonant crystal inserted in series between the emitter and the rest of the tank</p>  <p>circuit. Nat. Lab.</p> <p style="text-align: right;">Kurt Wessendorf, Sandia</p>
<p>Clapp type oscillator</p>	 <p style="text-align: right;">Refinement of a Colpitts oscillator including an additional capacitor (C0) in series with the inductor. Series tuned version of the Colpitts oscillator.</p>
<p>Colpitts type oscillator</p>	 <p style="text-align: right;">Oscillator</p> <p>with feedback via a capacitive voltage divider (C1,C2). Can be LC or may include another resonator (e.g. a crystal) instead of or in addition to the inductor (L). Can also be balanced, e.g.</p>  <p>US2006097799 P.P. Guebels :</p>
<p>Hartley</p>	 <p style="text-align: right;">LC oscillator with feedback via an inductive voltage divider.</p>

<p>Pierce type oscillator</p>	 <p>Oscillator comprising an amplifier, a crystal resonator connected in series in its feedback path and load capacitors at the input and output.</p>
<p>Wien bridge oscillator</p>	 <p>Positive gain amplifier with a bridge circuit comprising a series RC circuit and a parallel RC circuit to provide positive feedback.</p>

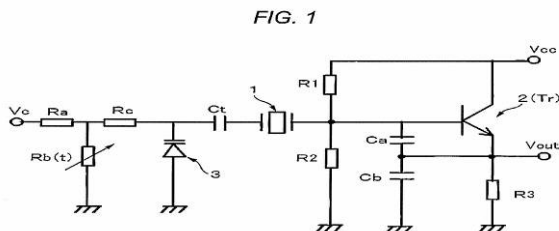
H03B 5/04

Modifications of generator to compensate for variations in physical values, e.g. power supply, load, temperature

Definition statement

This place covers:

Patent Application Publication Apr. 29, 2010 Sheet 1 of 6 US 2010/0102892 A1



US20100102892, J. Arai

Rb(t): Temperature sensing resistor within the oscillator, considered as a "modification of the generator" falling within the scope of [H03B 5/04](#).

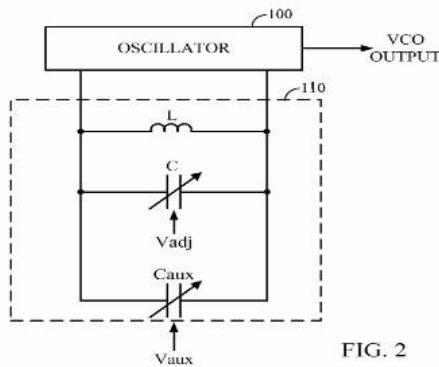


FIG. 2

US2009261917, M. Taghivand Et al.: temperature compensating varactor receives control signal from outside the oscillator. NOT to be classified in [H03B 5/04](#), but instead in [H03L 1/023](#), because it is not a "modification of the generator" itself.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Stabilisation of generator output against variations of temperature	H03L 1/02
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H03B 5/10

active element in amplifier being vacuum tube ([H03B 5/14](#) takes precedence)

Definition statement

This place covers:

Oscillators using amplifier with regenerative feedback with frequency-determining element comprising lumped inductance and capacitance and active element in amplifier being vacuum tube.

References

Limiting references

This place does not cover:

Frequency-determining element connected via bridge circuit to closed ring around which signal is transmitted	H03B 5/14
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H03B 5/12

active element in amplifier being semiconductor device ([H03B 5/14](#) takes precedence)

Definition statement

This place covers:

Oscillators using amplifier with regenerative feedback with frequency-determining element comprising lumped inductance and capacitance and active element in amplifier being semiconductor device. The majority of transistor based LC oscillators are classified here or in the subgroups.

References

Limiting references

This place does not cover:

Frequency-determining elements connected via bridge circuit to closed ring around which signal is transmitted	H03B 5/14
Oscillators with a lumped LC resonant circuit and the active element being a semiconductor device, but where the active element provides a negative resistance instead of using regenerative feedback.	H03B 7/06

Special rules of classification

Documents falling under [H03B 5/12](#) should generally receive multiple classifications from the subgroups and all relevant group symbols should be applied. Generally, it is required to apply at least one of the subgroups [H03B 5/1203](#) or [H03B 5/1206](#) to define the amplifier configuration, at least one of the subgroups [H03B 5/1228](#) and [H03B 5/1231](#) to define the transistor types and possibly also one of the subgroups [H03B 5/1234](#) or [H03B 5/1237](#) to define any variable parameters.

H03B 5/1203

{the amplifier being a single transistor}

Definition statement

This place covers:

Oscillators using an amplifier with regenerative feedback and a frequency-determining element comprising lumped inductance and capacitance, the active element in the amplifier being a single transistor.

References

Limiting references

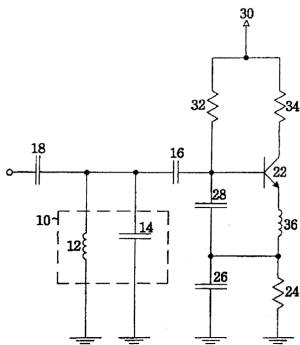
This place does not cover:

Any oscillators with more than one transistor for amplification	H03B 5/1206
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Special rules of classification

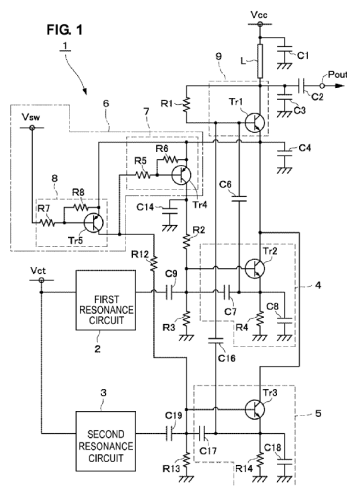
The single-transistor-amplifier should be the amplifier that provides the gain in the oscillation loop. Other amplifiers, e.g. connected after the oscillator and outside the loop are not considered when deciding if a single transistor is used. Auxiliary transistors that are provided for a purpose other than amplification, e.g. as a current source or a switch, are also not counted. Hence any oscillator with a single amplification transistor should be classified here. In general further subgroup symbols under [H03B 5/12](#) will also be added in combination with this one.

Example:



WO0211277, Y.M. Yeong

Single transistor 22 used for amplification in the oscillation loop.



US2008309415, T. Aramata

The circuit contains 5 transistors, but two (Tr4 and Tr5) are used for switching and one (Tr1) is a buffer at the output, these are therefore outside of the oscillation loop and not used for providing gain. The remaining two are providing gain, but in separate oscillation loops. This therefore effectively shows two oscillators, each with a single amplification transistor and is classified in [H03B 5/1203](#).

H03B 5/1206

{using multiple transistors for amplification}

Definition statement

This place covers:

Oscillators using an amplifier with regenerative feedback and a frequency-determining element comprising lumped inductance and capacitance, the active element in the oscillation amplifier using more than one transistor to provide the gain.

Particular configurations of the multiple amplification transistors:

- Oscillators with differential amplifiers and no cross coupling
- Cross coupled oscillators
- Oscillators with differential amplifiers and cross coupling

- Balanced oscillators
- Oscillators with multistage amplifiers
- Oscillators with multiple amplifiers connected in parallel

Special rules of classification

This group and its subgroups are intended to contain oscillators where multiple transistors are used to provide the gain for a single oscillation loop. For example, differential amplifiers, multistage amplifiers, multiple amplifiers connected in parallel and to a common resonator are all to be found here or in subgroups. Other amplifiers, e.g. connected after the oscillator and outside the loop are not considered for determination whether multiple transistors are present. Auxiliary transistors that are provided for a purpose other than amplification, e.g. as a current source or a switch, are also not counted, so an oscillator comprising a single amplification transistor and a further transistor for switching off the oscillator, would NOT be classified here, but instead as a single transistor in [H03B 5/1203](#).

H03B 5/1209

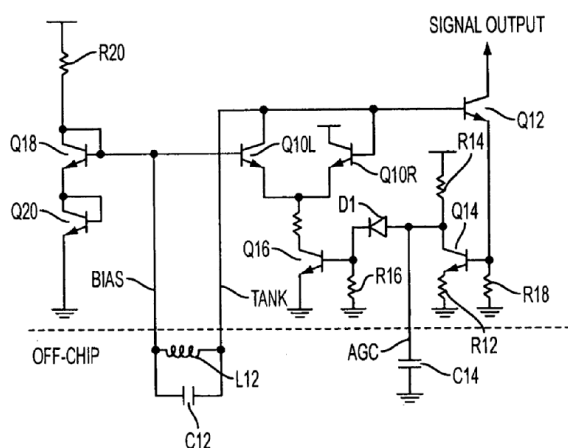
{the amplifier having two current paths operating in a differential manner and a current source or degeneration circuit in common to both paths, e.g. a long-tailed pair. (H03B 5/1215 takes precedence)}

Definition statement

This place covers:

Oscillators using an amplifier with regenerative feedback and a frequency-determining element comprising lumped inductance and capacitance, the active element in the oscillation amplifier for oscillation using more than one transistor and having two current paths conducting a differential current, i.e. being a differential amplifier. A current source or degeneration circuit in common to both paths provides current which is then split between the two current paths.

Example:



US2007182503, J.G. Petrofsky

Q10L and Q10R are a differential pair and Q16 is the common current source of the differential amplifier. C12 and L12 make the resonator. There is no cross coupling between the transistors of the differential pair.

References

Limiting references

This place does not cover:

Oscillators where the amplifier is a cross-coupled transistor pair	H03B 5/1215
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H03B 5/1212

{the amplifier comprising a pair of transistors, wherein an output terminal of each being connected to an input terminal of the other, e.g. a cross coupled pair}

Definition statement

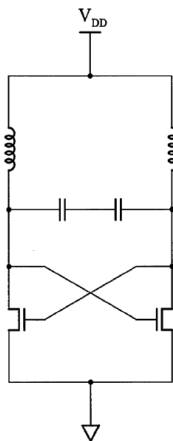
This place covers:

Oscillators using an amplifier with regenerative feedback and a frequency-determining element comprising lumped inductance and capacitance, the active element in the oscillation amplifier for oscillation comprising a pair of cross-coupled transistors.

Special rules of classification

This group contains any oscillators where the amplifier contains a pair of transistors the output of each one being connected to the input of the other. The normal case is a cross-coupled emitter or source-coupled pair, but other configurations are also possible.

Example:



US2008258827, M. Tsai

LC oscillator comprising a cross-coupled source-coupled pair of transistors.

H03B 5/1215

{the current source or degeneration circuit being in common to both transistors of the pair, e.g. a cross-coupled long-tailed pair}

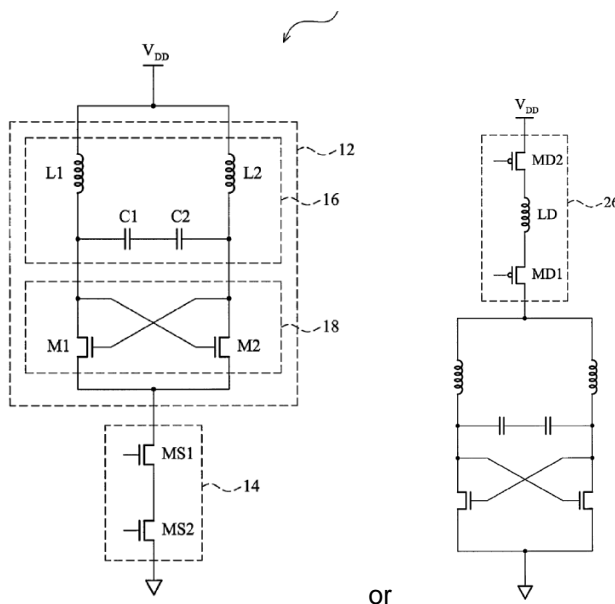
Definition statement

This place covers:

Oscillators using an amplifier with regenerative feedback and a frequency-determining element comprising lumped inductance and capacitance, the active element in the oscillation amplifier for oscillation comprising a pair of cross-coupled transistors and a current source or degeneration circuit in common to both paths.

Any oscillators where the amplifier contains a pair of transistors the output of each one being connected to the input of the other and further having a common current source (or degeneration circuit). The current source or degeneration circuit in common to both transistors provides current which is then split between the current paths of the two transistors, hence these are LC oscillators using cross coupled differential amplifiers.

Example:



both from US2008258827, M. Tsai

Circuits 14 and 26 act as a current source in common to both transistors of the respective cross-coupled pair and building a differential amplifier.

H03B 5/1218

{the generator being of the balanced type}

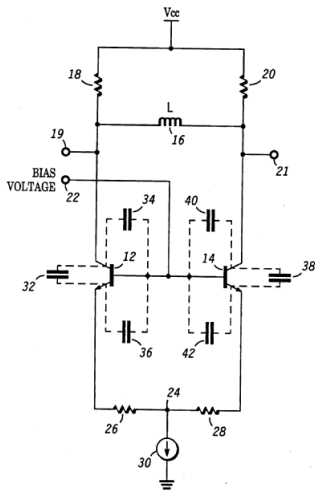
Definition statement

This place covers:

Oscillators using an amplifier with regenerative feedback and a frequency-determining element comprising lumped inductance and capacitance, the active element in the oscillation amplifier comprising multiple transistors and the generator being of the balanced type.

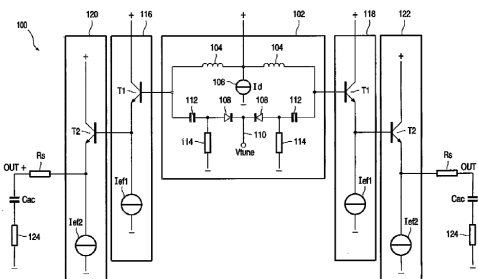
Here a balanced oscillator is not considered to include the differential type with a cross coupled transistor pair. Instead balanced oscillators are considered to include configurations where at least two amplifiers operate with separate oscillation circuits which are however coupled in such a way as to provide a balanced output. Often a single resonant circuit is coupled between both amplifiers.

Example:



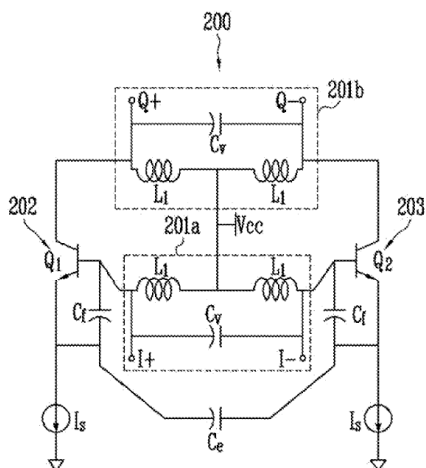
US5012205, W.J. Howell

Transistors 12 and 14 build a balanced type oscillator.



WO2004075394, H. Veenstra

Both two-stage emitter follower circuits provide gain to the single resonant circuit, but are coupled at opposite sides of it to provide a balanced output.



US2008129392, J.Y. Lee

Two colpitts type oscillators coupled in a balanced configuration

H03B 5/1221

{the amplifier comprising multiple amplification stages connected in cascade}

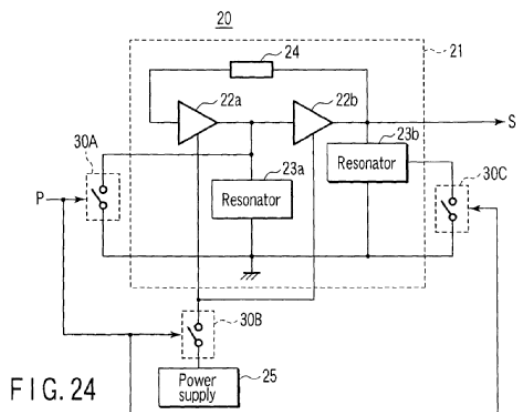
Definition statement

This place covers:

Oscillators using an amplifier with regenerative feedback and a frequency-determining element comprising lumped inductance and capacitance, the oscillation amplifier comprising multiple stages in cascade.

Any oscillators where the amplifier contains multiple stages in cascade. This is not considered to include the case where a differential pair is cross coupled (which is instead considered to be a single differential stage) .

Example:



EP1753136, Y. ARAYASHIKI

Two amplifier stages 22a and 22b in a single loop.

H03B 5/1225

{the generator comprising multiple amplifiers connected in parallel}

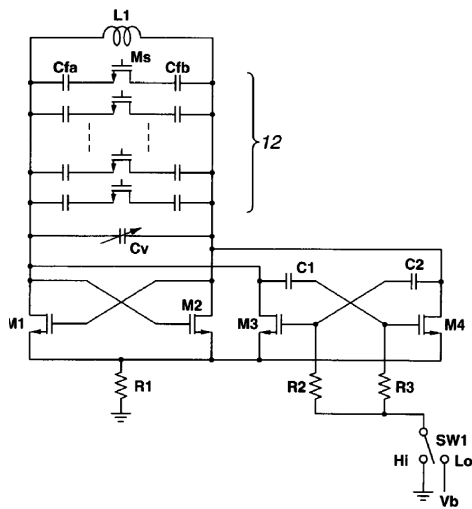
Definition statement

This place covers:

Oscillators using an amplifier with regenerative feedback and a frequency-determining element comprising lumped inductance and capacitance, the oscillation amplifier comprising multiple amplifier circuits in parallel.

This subgroup contains any oscillators where the amplifier contains multiple amplifier circuits in parallel, i.e. the inputs of each amplifier are connected together, as are the outputs. It also includes circuits where some or all of the parallel amplifier circuits are or can be switched in or out of the circuit, for example to provide multiple gain levels or for startup. It does not include cases where separate amplifiers are connected to different resonant circuits and therefore not in parallel.

Example:



US2009289732, D. MIYASHITA

An amplifier consisting of transistors M3 and M4 can be switched in parallel with M1, M2 to provide different gain levels.

H03B 5/1228

{the amplifier comprising one or more field effect transistors}

Definition statement

This place covers:

Oscillators using an amplifier with regenerative feedback and a frequency-determining element comprising lumped inductance and capacitance, the active element in the amplifier comprising at least one FET.

References

Limiting references

This place does not cover:

Oscillators where a variable capacitance is provided by a FET transistor	H03B 5/1253
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Special rules of classification

The group includes oscillator circuits where the amplifier of the oscillation loop comprises at least one FET. Where the amplifier includes both FET and bipolar transistors, also the classification [H03B 5/1231](#) should be applied. This group is intended to indicate only the type of transistors used in the amplifier of the oscillation loop, but those transistors can be used to provide the gain or for other auxiliary purposes, e.g. for biasing. Hence an amplifier using one transistor type for amplification and another for biasing should receive both group symbols [H03B 5/1228](#) and [H03B 5/1231](#). This class is not applied to classify transistor types used at other places in the circuit, for example buffer circuits at the output and therefore not inside the oscillation loop. It is also not used to distinguish transistor types used in the oscillation loop but not part of the amplifier - for example the type of transistors providing a voltage dependent capacitance are classified in the groups [H03B 5/125](#) and [H03B 5/1253](#).

H03B 5/1231

{the amplifier comprising one or more bipolar transistors}

Definition statement

This place covers:

Oscillators using an amplifier with regenerative feedback and a frequency-determining element comprising lumped inductance and capacitance, the active element in the amplifier comprising at least one bipolar transistor.

References

Limiting references

This place does not cover:

Oscillators where a variable capacitance is provided by a bipolar transistor	H03B 5/125
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Special rules of classification

The subgroup includes oscillator circuits where the amplifier of the oscillation loop comprises at least one bipolar transistor. Where the amplifier includes both FET and bipolar transistors, also the classification [H03B 5/1228](#) should be applied. This group is intended to indicate only the type of transistors used in the amplifier of the oscillation loop, but those transistors can be used to provide the gain or for other auxiliary purposes, e.g. for biasing. Hence an amplifier using one transistor type for amplification and another for biasing should receive both group symbols [H03B 5/1228](#) and [H03B 5/1231](#). This class is not applied to classify transistor types used at other places in the circuit, for example buffer circuits at the output and therefore not inside the oscillation loop. It is also not used to distinguish transistor types used in the oscillation loop but not part of the amplifier - for example the type of transistors providing a voltage dependent capacitance are classified in the groups [H03B 5/125](#) and [H03B 5/1253](#).

H03B 5/1234

**{and comprising means for varying the output amplitude of the generator
([H03B 5/1278](#) takes precedence)}**

Definition statement

This place covers:

Oscillators using an amplifier with regenerative feedback and a frequency-determining element comprising lumped inductance and capacitance, the active element being a semiconductor device (e.g. a transistor) and further having means providing a variable output amplitude.

References

Limiting references

This place does not cover:

Varying the amplitude of the oscillator in dependence on the frequency	H03B 5/1278
Automatic control of the amplitude (voltage, current or power) of generators.	H03L 5/00

H03B 5/1237

{comprising means for varying the frequency of the generator}

Definition statement

This place covers:

Oscillators using an amplifier with regenerative feedback and a frequency-determining element comprising lumped inductance and capacitance, the active element being a semiconductor device (e.g. a transistor) and the frequency being tunable.

Particular aspects of the frequency tuning:

- Tuning by means of voltage dependent capacitors
- Tuning by means of variable inductors
- Tuning by means of switched components
- Tuning by a control current
- Controlling other parameters in dependence on the frequency
- Means for achieving particular tuning characteristics

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Frequency modulation by means of variable impedance	H03C 3/10
Tuning in general	H03J
Automatic control of the frequency or phase of generators, e.g. by a PLL.	H03L 7/00

H03B 5/1271

{the frequency being controlled by a control current, i.e. current controlled oscillators}

Definition statement

This place covers:

Oscillators using an amplifier with regenerative feedback and a frequency-determining element comprising lumped inductance and capacitance, the active element being a semiconductor device (e.g. a transistor) and the frequency being tuned by a control current.

All types of current controlled oscillators are classified here, regardless of whether the control current is applied to a current dependent inductor or capacitor or whether it is applied elsewhere (e.g. as a bias to an active element) where a frequency tuning is thereby achieved. Additional group symbols should be applied where appropriate, e.g. typically [H03B 5/124](#), [H03B 5/1256](#) or their subgroups.

H03B 5/1275

{having further means for varying a parameter in dependence on the frequency}

Definition statement

This place covers:

Oscillators using an amplifier with regenerative feedback and a frequency-determining element comprising lumped inductance and capacitance, the active element being a semiconductor device (e.g. a transistor), the frequency being tuned and additionally having means for achieving a desired tuning characteristic.

Typically the desired tuning characteristic is a linear control voltage to frequency characteristic, but this subgroup covers any measures to obtain any tuning characteristic. For example, stepwise linear functions or higher and subgroupser tuning sensitivity (which amount to a steeper/less steep tuning curve) are also covered.

H03B 5/1293

{having means for achieving a desired tuning characteristic, e.g. linearising the frequency characteristic across the tuning voltage range}

Definition statement

This place covers:

Oscillators using an amplifier with regenerative feedback and a frequency-determining element comprising lumped inductance and capacitance, the active element being a semiconductor device (e.g. a transistor), the frequency being tuned and another parameter also being varied (continuously or in steps) in dependence on the oscillation frequency.

Typical examples for documents to be classified here or in the subgroups are:

- where the gain is controlled such that the output amplitude remains constant over the frequency range, which would be classified in the subgroup [H03B 5/1278](#) and depending on the specific implementation perhaps also in [H03B 5/1281](#) or [H03B 5/129](#).
- where the oscillator comprises a filter to select a specific harmonic component of the fundamental resonant frequency and that frequency is tuned in tandem with the tuning of the resonant circuit, which would be classified in [H03B 5/1284](#)

H03B 5/1296

{the feedback circuit comprising a transformer}

Definition statement

This place covers:

Oscillators using an amplifier with regenerative feedback and a frequency-determining element comprising lumped inductance and capacitance, the active element being a semiconductor device (e.g. a transistor) and further having a transformer in the feedback path.

H03B 5/1811

{the active element in the amplifier being a vacuum tube (see provisionally also [H03B 5/1835](#))}

Definition statement

This place covers:

Oscillators using amplifier with regenerative feedback and frequency-determining element comprising distributed inductance and capacitance and being a coaxial resonator and the active element in the amplifier being a vacuum tube.

References**Limiting references**

This place does not cover:

Active elements in the amplifier being a vacuum tube	H03B 5/1835
--	-----------------------------

H03B 5/1817

{the frequency-determining element being a cavity resonator}

Definition statement

This place covers:

Oscillators using amplifier with regenerative feedback and the frequency-determining element being a cavity resonator.

Physical details of cavity resonators that can be regarded as distributed inductances.

Example of an oscillator with cavity resonator:

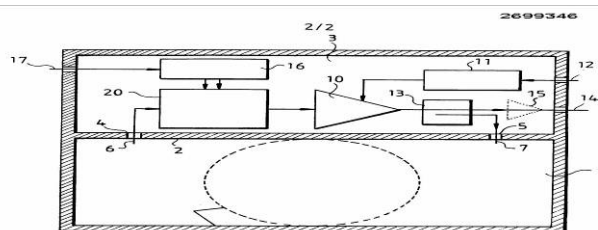


FIG. 4

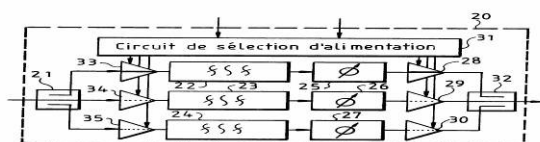


FIG. 5

FR2699346, L. Fourdan

1: cavity

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Cavity resonators	H01P 7/06
-------------------	---------------------------

H03B 5/1841

{the frequency-determining element being a strip line resonator ([H03B 5/1805](#), [H03B 5/1817](#), [H03B 5/1864](#) and [H03B 5/1882](#) take precedence)}

Definition statement

This place covers:

Oscillators using amplifier with regenerative feedback and the frequency-determining element being a strip-line resonator.

References

Limiting references

This place does not cover:

Frequency-determining elements being a coaxial resonator	H03B 5/1805
Frequency-determining elements being a cavity resonator	H03B 5/1817
Frequency-determining elements being a dielectric resonator	H03B 5/1864
Frequency-determining element being a magnetic-field sensitive resonator	H03B 5/1882

Special rules of classification

Resonators comprising a strip-line and another of the resonator types defined in the other subgroups of [H03B 5/18](#), i.e. coaxial, cavity, dielectric or field sensitive resonators, are classified according to the other resonator, i.e. not in [H03B 5/1841](#).

H03B 5/1847

{the active element in the amplifier being a semiconductor device}

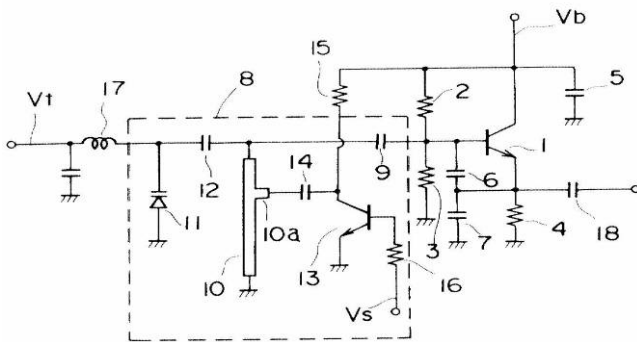
Definition statement

This place covers:

Oscillators using amplifier with regenerative feedback and the frequency-determining element being a strip-line resonator and the active element in the amplifier being a semiconductor device.

Example:

FIG. 1



EP1117177, T. Tanemura

The resonance circuit (8) comprises a microstrip line (10); the active element in the amplifier is a semiconductor device (1).

H03B 5/1852

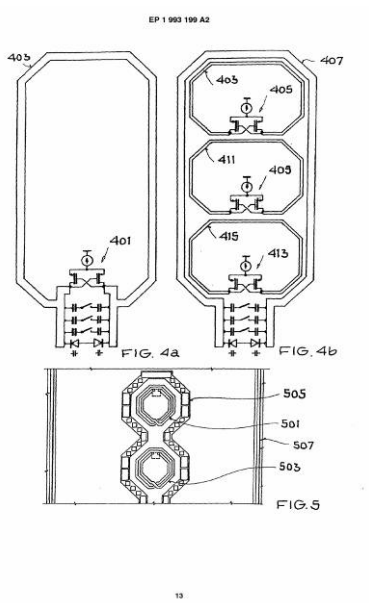
{the semiconductor device being a field-effect device}

Definition statement

This place covers:

Oscillators using amplifier with regenerative feedback and the frequency-determining element being a strip-line resonator and the active element in the amplifier being a field-effect device.

Example:



EP1993199, S. El Rair

The resonance circuit comprises microstrip lines (403, 407, 411, 415,); the semiconductor device in the amplifiers (405, 409, 413) are field effect transistors.

H03B 5/22**active element in amplifier being vacuum tube ([H03B 5/26](#) takes precedence)****Definition statement***This place covers:*

Oscillators using amplifier with regenerative feedback and frequency-determining element comprising resistance and either capacitance or inductance and active element in amplifier being vacuum tube.

References**Limiting references***This place does not cover:*

Frequency-determining elements being part of bridge circuit in closed ring around which signal is transmitted; frequency-determining elements being connected via a bridge circuit to such a closed ring	H03B 5/26
--	---------------------------

H03B 5/24**active element in amplifier being semiconductor device ([H03B 5/26](#) takes precedence)****Definition statement***This place covers:*

Oscillators using amplifier with regenerative feedback and frequency-determining element comprising resistance and either capacitance or inductance and active element in amplifier being semiconductor device.

Example:

Patent Application Publication Sep. 16, 2010 Sheet 1 of 2 US 2010/0231311 A1

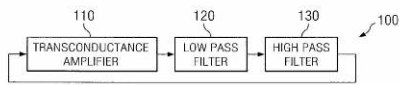


FIG. 1A

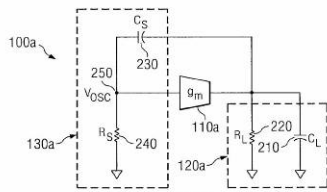


FIG. 2

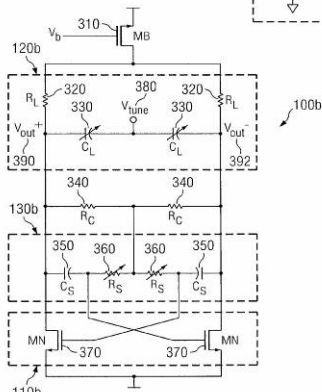


FIG. 3

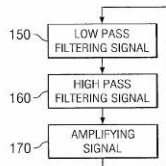


FIG. 1B

US2010231311, S.W. Park

Example of an RC oscillator

References

Limiting references

This place does not cover:

Frequency-determining elements being part of bridge circuit in closed ring around which signal is transmitted; frequency-determining element being connected via a bridge circuit to such a closed ring	H03B 5/26
---	---------------------------

H03B 5/26

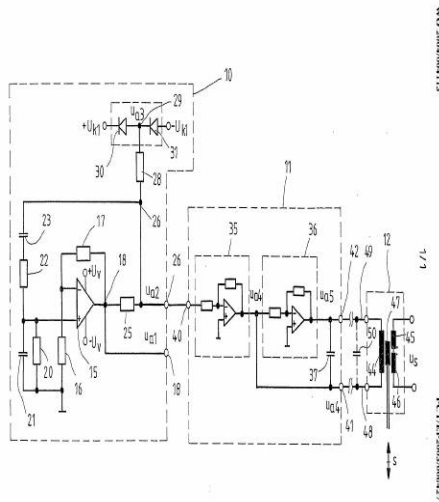
frequency-determining element being part of bridge circuit in closed ring around which signal is transmitted; frequency-determining element being connected via a bridge circuit to such a closed ring, e.g. Wien-Bridge oscillator, parallel-T oscillator

Definition statement

This place covers:

Oscillators using amplifier with regenerative feedback and frequency-determining element comprising resistance and either capacitance or inductance and frequency-determining element being part of bridge circuit in closed ring around which signal is transmitted; frequency-determining element being connected via a bridge circuit to such a closed ring. Most commonly these are Wien Bridge type oscillators.

Example:



EP1520339, K. Panzer

RC oscillator in Wien-bridge configuration

H03B 5/32

being a piezo-electric resonator (selection of piezo-electric material [H01L 41/00](#))

Definition statement

This place covers:

Oscillators using amplifier with regenerative feedback with frequency-determining element being a piezo-electric resonator

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Selection of piezo-electric material	H01L 41/00
--------------------------------------	----------------------------

H03B 5/323

{the resonator having more than two terminals ([H03B 5/326](#) takes precedence)}

Definition statement

This place covers:

Oscillators using amplifier with regenerative feedback with frequency-determining element being a piezo-electric resonator having more than two terminals.

References

Limiting references

This place does not cover:

Resonators being an acoustic wave device	H03B 5/326
--	----------------------------

H03B 5/34

active element in amplifier being vacuum tube ([H03B 5/38](#) takes precedence)

Definition statement

This place covers:

Oscillators using amplifier with regenerative feedback with frequency-determining element being a piezo-electric resonator and active element in amplifier being vacuum tube.

References

Limiting references

This place does not cover:

Frequency-determining elements being connected via bridge circuit to closed ring around which signal is transmitted	H03B 5/38
---	---------------------------

H03B 5/36

active element in amplifier being semiconductor device ([H03B 5/323](#), [H03B 5/326](#)), [H03B 5/38](#) take precedence)

Definition statement

This place covers:

Oscillators using amplifier with regenerative feedback with frequency-determining element being a piezo-electric resonator and active element in amplifier being semiconductor device.

References

Limiting references

This place does not cover:

Resonators having more than two terminals	H03B 5/323
Resonators being an acoustic wave device	H03B 5/326
Frequency-determining elements being connected via bridge circuit to closed ring around which signal is transmitted	H03B 5/38

H03B 5/362

{the amplifier being a single transistor ([H03B 5/364](#) - [H03B 5/368](#) take precedence)}

Definition statement

This place covers:

Oscillators using amplifier with regenerative feedback with frequency-determining element being a piezo-electric resonator and active element in amplifier being a single transistor.

Example:

Patent Application Publication Jul. 24, 2008 Sheet 1 of 3 U.S. 2008/0174377 A1

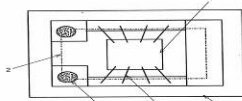
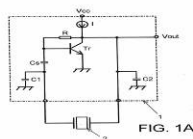


FIG. 1B US2008174377, T. Makuta et al.,

Oscillator including an electromechanical resonator (2) and a single transistor amplifier (Tr).

References

Limiting references

This place does not cover:

Amplifiers comprising field effect transistors	H03B 5/364
Means for varying the frequency by a variable voltage or current	H03B 5/366
Voltage variable capacitance diodes for varying the frequency	H03B 5/368

H03B 5/364

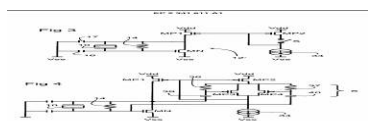
{the amplifier comprising field effect transistors ([H03B 5/366](#) takes precedence)}

Definition statement

This place covers:

Oscillators using amplifier with regenerative feedback with frequency-determining element being a piezo-electric resonator and active element in amplifier comprising field effect transistors.

Example:



EP2341611, S. Ramet

Oscillator including an electromechanical resonator (10) and an amplifier comprising a field effect transistor (MN).

References

Limiting references

This place does not cover:

Means for varying the frequency by a variable voltage or current	H03B 5/366
--	----------------------------

H03B 5/368

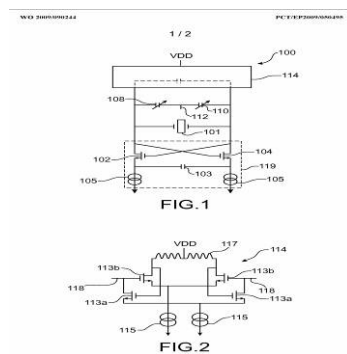
{the means being voltage variable capacitance diodes}

Definition statement

This place covers:

Oscillators using amplifier with regenerative feedback with frequency-determining element being a piezo-electric resonator and active element in amplifier being semiconductor device and comprising voltage variable capacitance diodes for varying the frequency.

Example:



EP2243215; J.-B. David et al

Oscillator including an electromechanical resonator (101) and voltage variable diodes (108, 110) to vary the frequency.

H03B 5/40

being a magnetostrictive resonator ([H03B 5/42](#) takes precedence; selection of magneto-strictive material {[H01F 1/00](#)} ; [H01L 41/00](#))

Definition statement

This place covers:

Oscillators using amplifier with regenerative feedback with frequency-determining element being a magnetostrictive resonator.

References

Limiting references

This place does not cover:

Frequency-determining elements connected via bridge circuit to closed ring around which signal is transmitted	H03B 5/42
---	---------------------------

Informative references

Attention is drawn to the following places, which may be of interest for search:

Magnetic materials in general	H01F 1/00
Magnetostrictive elements in general	H01L 41/00

H03B 7/00

Generation of oscillations using active element having a negative resistance between two of its electrodes ([H03B 9/00](#) takes precedence)

Definition statement

This place covers:

Oscillators comprising a device with negative differential resistance as active element

- Lumped LC tanks as frequency determining element
- Distributed L and C as frequency determining element

References**Limiting references**

This place does not cover:

Oscillators with regenerative feedback including gain elements such as amplifiers or transistors	H03B 5/00
Generation of oscillations using transit-time effects	H03B 9/00
Gunn diodes, in so far as their transit-time effect is relevant	H03B 9/12

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Negative resistance, negative conductance	A property of an electrical component or circuit characterised in that the relationship between voltage and current in the component exhibits a negative differential resistance at some point in the operating characteristic of the component. NOT: gain element like amplifier or transistor
---	---

Synonyms and Keywords

In patent documents, the following abbreviations are often used:

Gunn diode	Diode, typically built as monopolar homojunction exhibiting negative differential resistance
RTD	Resonant tunnelling diode, typically built by a heterojunction multilayer structure with negative differential resistance
YIG	Yttrium iron garnet, resonating at microwave frequencies when immersed in a DC magnetic field

H03B 7/06

active element being semiconductor device

Definition statement

This place covers:

Oscillators using active element having a negative resistance between two of its electrodes with frequency-determining element comprising lumped inductance and capacitance and active element being semiconductor device.

Oscillators with negative differential resistance elements such as Gunn diodes in so far as their transit time effect is not relevant.

H03B 7/08

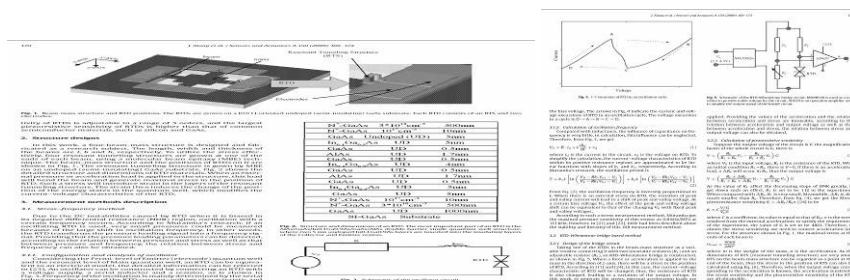
being a tunnel diode

Definition statement

This place covers:

Oscillators using active element having a negative resistance between two of its electrodes with frequency-determining element comprising lumped inductance and capacitance and active element being a tunnel diode.

Example:



Xiong et al., Sensors and actuators A, 150 (2009), p. 169

Oscillator using a resonant tunnel diode (RTD) as an element with negative differential resistance

H03B 7/14

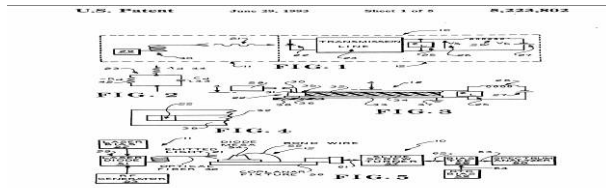
active element being semiconductor device

Definition statement

This place covers:

Oscillators using active element having a negative resistance between two of its electrodes with frequency-determining element comprising distributed inductance and capacitance and active element being a semiconductor device.

Example:



US5223802, J.F. Harvey

Oscillator with frequency determining element comprising transmission as distributed inductance and a resonant tunnel diode (22) as an active semiconductor device with negative differential resistance.

H03B 9/00

Generation of oscillations using transit-time effects {(construction of tube and circuit arrangements not adapted to a particular application [H01J](#); construction of the semiconductor devices [H01L](#))}

Definition statement

This place covers:

Oscillators comprising a device with transit-time effects as frequency determining element:

- discharge tubes
- solid state devices, e.g. Gunn-effect devices

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Construction of tube and circuit arrangements not adapted to a particular application	H01J
Semiconductor devices per se	H01L

Special rules of classification

Gunn diodes, in so far as only their negative differential resistance is relevant, not their transit time effect, are classified in [H03B 7/06](#).

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Transit-time effect	oscillation period equal to transit time
---------------------	--

Synonyms and Keywords

In patent documents, the following abbreviations are often used:

Impatt diode	IMPact ionization Avalanche Transit-Time
Schottky diode	Diode formed by a metal-semiconductor junction
Gunn diode	Diode, typically built as monopolar homojunction exhibiting negative differential resistance

H03B 9/02

using a retarding-field tube (using klystrons [H03B 9/04](#))

References

Limiting references

This place does not cover:

Using klystrons	H03B 9/04
-----------------	---------------------------

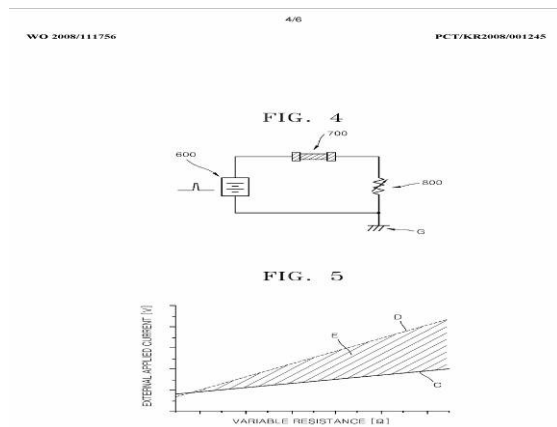
H03B 9/12

using solid state devices, e.g. Gunn-effect devices

Definition statement

This place covers:

Examples:

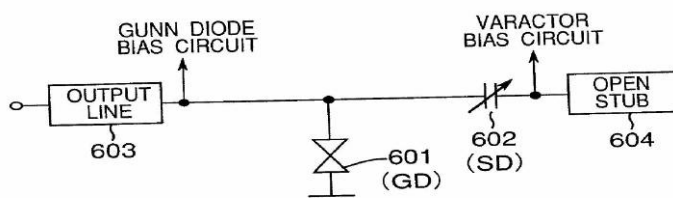


US2010085126, Y.-W. Lee et al.

Oscillator with metal-insulator device (700)

Patent Application Publication Jan. 31, 2002 Sheet 3 of 6 US 2002/0011604 A1

Fig.3



US2002011604, M. Yagura et al.

Gunn-diode (601) based oscillator

H03B 9/145

{the frequency being determined by a cavity resonator, e.g. a hollow waveguide cavity or a coaxial cavity ([H03B 9/141](#) - [H03B 9/143](#), [H03B 9/147](#), [H03B 9/148](#) take precedence)}

Definition statement

This place covers:

Generation of oscillations using transit-time effects in solid state devices and elements comprising distributed inductance and capacitance, the frequency being determined by a cavity resonator

References

Limiting references

This place does not cover:

Voltage sensitive elements	H03B 9/141
Magnetic field sensitive elements	H03B 9/142
More than one solid state device	H03B 9/143
Frequency being determined by a stripline resonator	H03B 9/147
Frequency being determined by a dielectric resonator	H03B 9/148

H03B 9/147

{the frequency being determined by a stripline resonator ([H03B 9/141](#) - [H03B 9/143](#), [H03B 9/148](#) take precedence)}

References

Limiting references

This place does not cover:

Voltage sensitive elements	H03B 9/141
Magnetic field sensitive elements	H03B 9/142
More than one solid state device	H03B 9/143
Frequency being determined by a dielectric resonator	H03B 9/148

H03B 9/148

{the frequency being determined by a dielectric resonator ([H03B 9/141](#) - [H03B 9/143](#) take precedence)}

References

Limiting references

This place does not cover:

Voltage sensitive elements	H03B 9/141
Magnetic field sensitive elements	H03B 9/142
More than one solid state device	H03B 9/143

H03B 11/00

Generation of oscillations using a shock-excited tuned circuit (with feedback [H03B 5/00](#))

Definition statement

This place covers:

Spark excited oscillation circuits

Interrupter excited oscillation circuits

References

Limiting references

This place does not cover:

Oscillators using a shock-excited tuned circuit with feedback	H03B 5/00
---	---------------------------

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

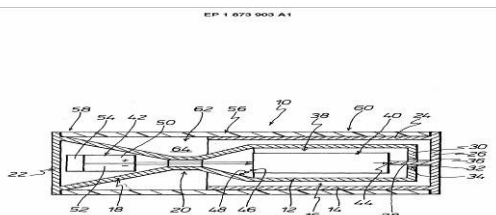
Shock-excited tuned circuit	Circuits where an electrical impulse is applied (repeatedly) to a resonant circuit which then oscillates freely at its resonant frequency. Not systems where oscillation is sustained by feedback.
-----------------------------	--

H03B 11/02

excited by spark (spark gaps therefor [H01T 9/00](#))

Definition statement

This place covers:



EP1873903

Microwave generator including a spark gap (36) between central (12) and external (14) electrode.

References

Limiting references

This place does not cover:

Spark gaps specially adapted for generating oscillations	H01T 9/00
--	---------------------------

H03B 13/00

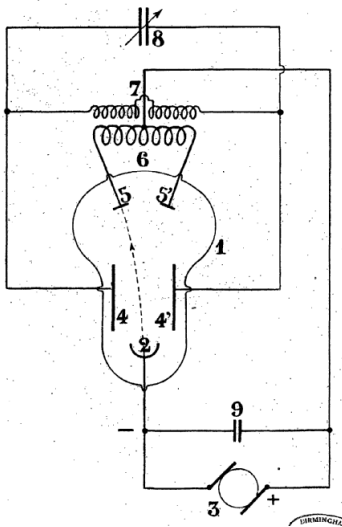
Generation of oscillations using deflection of electron beam in a cathode-ray tube

Definition statement

This place covers:

Oscillators based on cathode ray tubes with a feedback path.

Example:



GB 126019, J. Bethenod. Electric field applied between two plates 4 to steer the electron beam and oscillate it between the two anodes 5 and 5'.

H03B 15/00

Generation of oscillations using galvano-magnetic devices, e.g. Hall-effect devices, or using superconductivity effects

Definition statement

This place covers:

Oscillators based on galvano-magnetic devices

- Hall effect devices
- Superconductivity effects
- Spin transfer effects or giant magnetoresistance (GMR)

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Measuring magnetic variables	G01R 33/00
Recording by magnetisation	G11B 5/00
Magnetic memory devices	G11C 11/00
Thin magnetic films without application as an oscillator	H01F 10/00

Spin-exchange-coupled multilayers	H01F 10/32
Galvano-magnetic devices per se	H01L 43/00

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Spin torque	Torque of electron spin interacting with permanent magnetic field
Spin-transfer torque oscillator	Partially magnetized multilayer structure generating current oscillations when a DC voltage is applied
Spin valve	Partially magnetized multilayer structure leading to precession of electron spin of a traversing current
Josephson Junction	Two superconductors linked by a non-conducting barrier

Synonyms and Keywords

In patent documents, the following abbreviations are often used:

GMR	Giant magneto-resistance
TMR	Tunnel magneto-resistance
SMT	Spin momentum transfer
SV	Spin valve

H03B 17/00

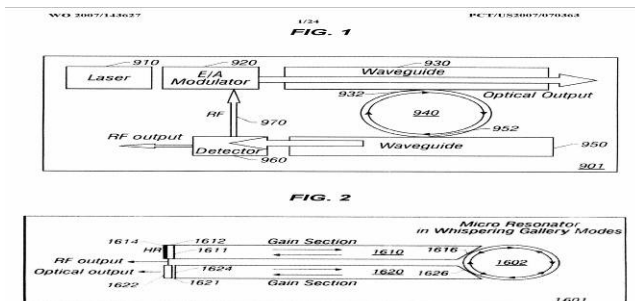
Generation of oscillations using radiation source and detector, e.g. with interposed variable obturator

Definition statement

This place covers:

Oscillators including a radiation source and detector, for example opto-electronic oscillators based on detection of optical signals. The radiation could be in the form of light, but also other radiation types, (e.g. terahertz radiation).

Example:



WO2007143627

Opto-electronic oscillator generating electronic oscillations by detecting an optical signal

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Obturator	This term is not used in any of the documents in this group and is apparently not significant.
-----------	--

H03B 19/00

Generation of oscillations by non-regenerative frequency multiplication or division of a signal from a separate source (transference of modulation from one carrier to another [H03D 7/00](#))

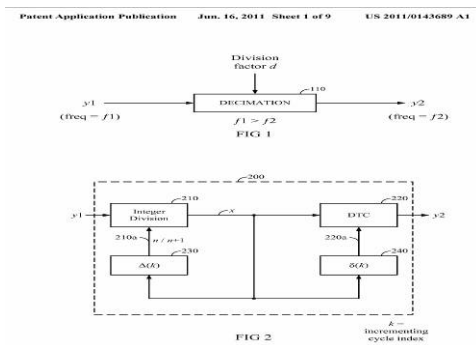
Definition statement

This place covers:

Generation of periodic sinusoidal waveforms based on an oscillating input signals and subsequent division or multiplication

- using non-linear inductance
- using non-linear capacitance, e.g. varactor diodes
- using discharge or semiconductor devices with more than two electrodes
- using uncontrolled rectifying devices such as diodes

Examples:



US2011143689

Generation of a periodic signal (y2) based on a higher frequency signal (y1) followed by configurable division (210) and a configurable delay (220).

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Generating clock signals	G06F 1/04
Transference of modulation from one carrier to another	H03D 7/00
Frequency dividers comprising counting chains	H03K 23/00

H03B 21/00

Generation of oscillations by combining unmodulated signals of different frequencies ([H03B 19/00](#) takes precedence; frequency changing circuits in general [H03D](#))

Definition statement

This place covers:

Combination of periodic unmodulated signals of different frequencies to form an oscillating signal

- by adding or subtracting unmodulated signals of different frequencies
- by selecting unmodulated signals of different frequencies
- by beating unmodulated signals of different frequencies

Example for [H03B 21/00](#):

U.S. Patent Jun. 27, 2000 Sheet 3 of 4 6,081,696

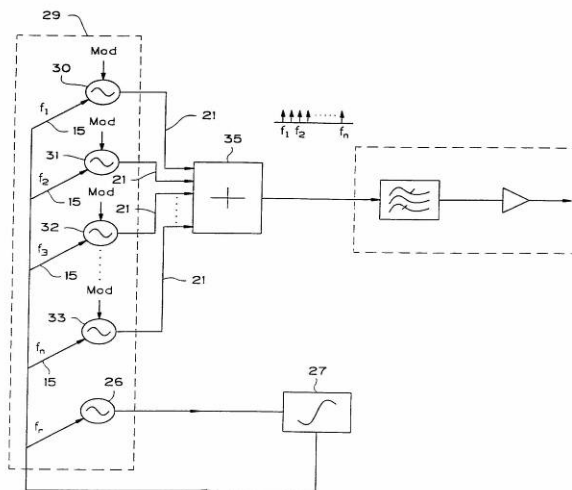


FIG. 3

US6081696

Generation of a multi-channel oscillation by adding independent signals of various frequencies.

References

Limiting references

This place does not cover:

Generation of oscillations by non-regenerative frequency multiplication or division of a signal from a separate source	H03B 19/00
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Modulation	H03C
Frequency changing circuits in general	H03D

Synonyms and Keywords

Beating	Mixing
---------	--------

H03B 21/01

by beating unmodulated signals of different frequencies

Definition statement

This place covers:

Example:

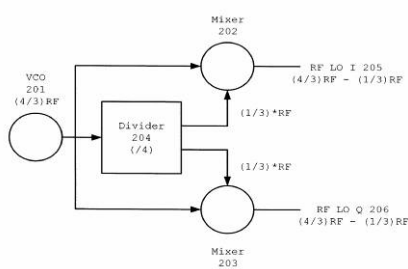


FIG. 2

U.S. Patent
Apr. 10, 2010
Sheet 2 of 2
US 7772932 B1

US7772932

Generation of an oscillation by mixing unmodulated signals of different frequencies ((4/3) RF and (1/3) RF)

H03B 21/02

by plural beating, i.e. for frequency synthesis {}; Beating in combination with multiplication or division of frequency (digital frequency synthesis using a ROM [G06F 1/02](#); digital frequency synthesis in general [H03K](#); indirect frequency synthesis using a PLL [H03L 7/16](#))}

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Digital frequency synthesis using a ROM	G06F 1/02
Digital frequency synthesis in general	H03K
Indirect frequency synthesis using a PLL	H03L 7/16

H03B 23/00

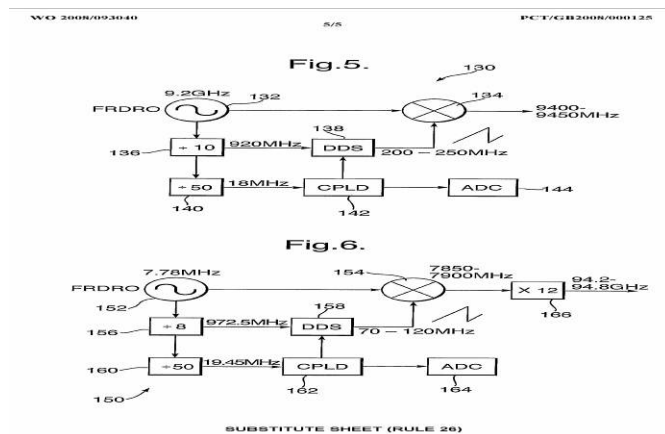
Generation of oscillations periodically swept over a predetermined frequency range (angle-modulating circuits in general [H03C 3/00](#))

Definition statement

This place covers:

Periodic sweeping of oscillation frequency

Examples:



Sweep of oscillation frequency of a radar generator (free running dielectric resonator oscillator, FRDRO) controlled by a complex programmable logic device (CPLD) and a direct digital synthesiser (DDS).

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Noise generation	H03B 29/00
Angle-modulating circuits in general	H03C 3/00

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

EMI	Electromagnetic interference
Spread spectrum generation	Deliberate spreading of a spectrum in the frequency domain
Bandwidth	Measure of the width of a range of frequencies occupied by an oscillating signal

Synonyms and Keywords

In patent documents, the following abbreviations are often used:

Frequency wobbling	Frequency sweeping
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H03B 25/00

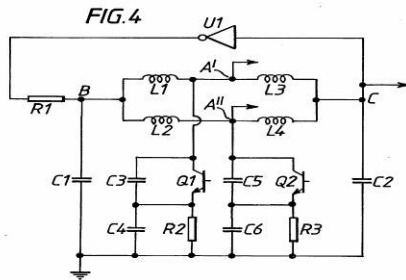
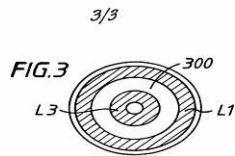
Simultaneous generation by a free-running oscillator of oscillations having different frequencies

Definition statement

This place covers:

Circuits and methods generating at least two oscillating signals differing in frequency.

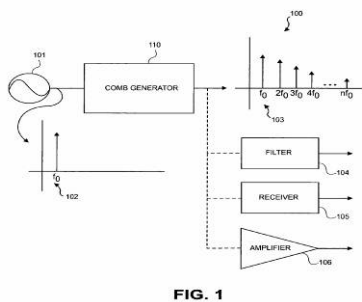
Examples:



GB2340681

Generation of three signals differing in frequency at individual outputs (A', A'', C)

Patent Application Publication Jul. 17, 2008 Sheet 1 of 8 US 2008/0169846 A1



US2008169846

Comb generator providing base frequency and harmonics

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Generation of oscillations providing a plurality of outputs of the same frequency but differing in phase	H03B 27/00
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Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Free-running oscillator	Oscillator with no tuning of frequency for a given set of tuning parameters.
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H03B 27/00

Generation of oscillations providing a plurality of outputs of the same frequency but differing in phase, other than merely two anti-phase outputs

Definition statement

This place covers:

Oscillators generating polyphase signals, such as quadrature oscillators.

Examples:

Patent Application Publication Jun. 23, 2011 Sheet 4 of 7 US 2011/0148535 A1

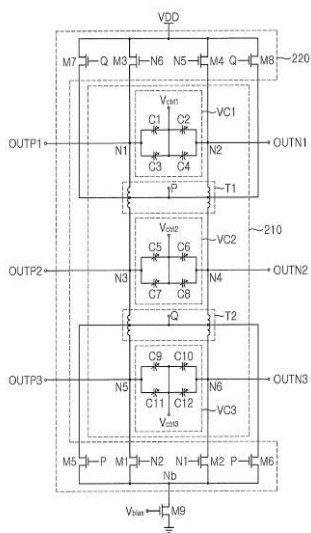
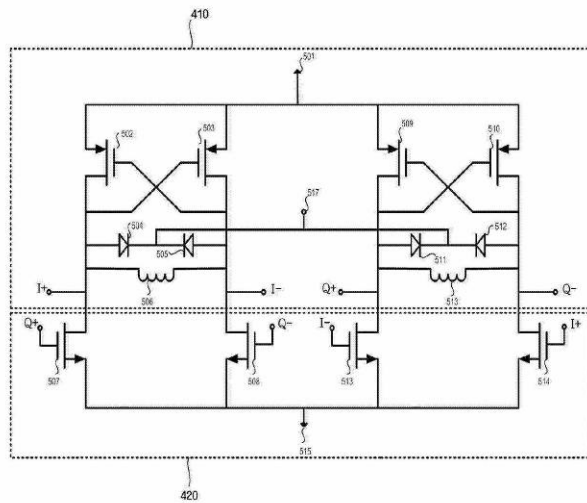


FIG. 6

US2011148535

Oscillator generating 6 signals of same frequency and 60° phase difference.

FIG. 5



EP1764911

Quadrature oscillator

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Quadrature oscillators	Oscillators generating two signals with same frequency shifted by 90°
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H03B 28/00

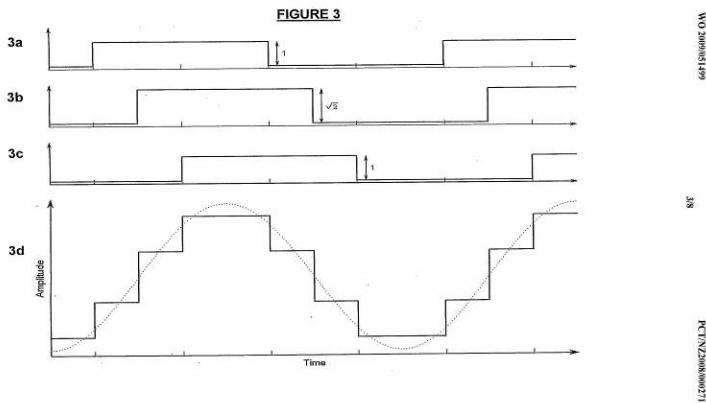
Generation of oscillations by methods not covered by groups [H03B 5/00](#) - [H03B 27/00](#), including modification of the waveform to produce sinusoidal oscillations (analogue function generators for performing computing operations [G06G 7/26](#); use of transformers for conversion of waveform in ac-ac converters [H02M 5/18](#))

Definition statement

This place covers:

Any types of oscillators which fall within the group definition for [H03B](#), but which do not fall within any of the main groups. Includes combining or filtering non-sinusoidal waves to generate a sinusoid.

Examples:



EP2206231

Summing of square waves to provide an approximation of a sinusoidal waveform

References

Limiting references

This place does not cover:

Generation of oscillations using amplifier with regenerative feedback from output to input	H03B 5/00
Generation of oscillations using active element having a negative resistance between two of its electrodes	H03B 7/00
Generation of oscillations using transit-time effects	H03B 9/00
Generation of oscillations using a shock-excited tuned circuit	H03B 11/00
Generation of oscillations using deflection of electron beam in a cathode-ray tube	H03B 13/00
Generation of oscillations using galvano-magnetic devices, e.g. Hall-effect devices, or using super-conductivity effects	H03B 15/00
Generation of oscillations using radiation source and detector	H03B 17/00
Generation of oscillations by non-regenerative frequency multiplication or division of a signal from a separate source	H03B 19/00
Generation of oscillations by combining unmodulated signals of different frequencies	H03B 21/00
Generation of oscillations periodically swept over a predetermined frequency range	H03B 23/00
Simultaneous generation by a free-running oscillator of oscillations having different frequencies	H03B 25/00
Generation of oscillations providing a plurality of outputs of the same frequency but differing in phase, other than merely two anti-phase outputs	H03B 27/00
Analogue function generators for performing computing operations	G06G 7/26

Informative references

Attention is drawn to the following places, which may be of interest for search:

Digital function generators	G06F 1/02
Use of transformers for conversion of waveform in ac-ac converters	H02M 5/18

H03B 29/00

Generation of noise currents and voltages {(gasfilled discharge tubes with solid cathode specially adapted as noise generators [H01J 17/005](#))}

Definition statement

This place covers:

Circuits used to generate random or noise signals e.g. Additive White Gaussian Noise (AWGN) or other noise distributions.

References**Limiting references**

This place does not cover:

Noise cancellation systems or generation of so-called noise signals for such systems, where the generated signal is a representation of the measured noise, not a random signal.	G10K 11/178
Gasfilled discharge tubes with solid cathode specially adapted as noise generators	H01J 17/005

H03B 2200/00

Indexing scheme relating to details of oscillators covered by [H03B](#)

Definition statement

This place covers:

Types of oscillators

Structural aspects of oscillators

Circuit elements of oscillators

Functional aspects of oscillators

References**Limiting references**

This place does not cover:

Oscillators with frequency-determining element comprising lumped inductance and capacitance using amplifier with regenerative feedback the active element of which comprising a semiconductor device and a voltage variable capacitance diode to vary the frequency	H03B 5/368
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Oscillators with frequency-determining element being an piezo-electric resonator using amplifier with regenerative feedback the active element of which comprising a semiconductor device and a voltage variable capacitance diode to vary the frequency	H03B 5/368
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H03B 2200/0094

Measures to ensure starting of oscillations

References

Limiting references

This place does not cover:

Oscillators using amplifier with regenerative feedback including modifications to ensure starting of oscillations	H03B 5/06
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