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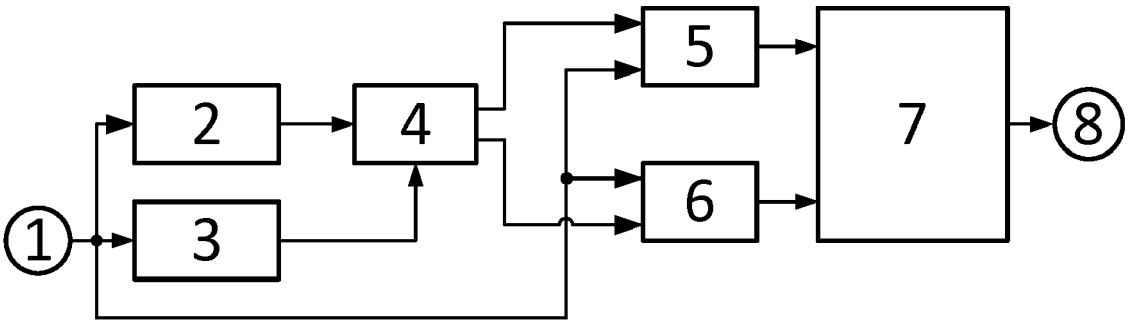
(54) **CONNECTION OF TRANSFORMER POWER SOURCE WITH WIDE INPUT RANGE**

(57) Connection of transformer power source with wide input range solves those cases when the power supply voltage ranges between two distant limit values, while the required output voltage remains constant. The basis of the solution is a transformer (7) with windings switched between by the switches (5, 6). These switches (5, 6) are controlled by a processor (4), which always after resetting when one limit voltage turns off and the other limit voltage turns on finds out from the output of the voltage converter (3), which voltage is connected to the input of the power supply source, and accordingly it switches on the relevant switch (5, 6), thus selecting the corresponding primary winding of the transformer (7). On the secondary winding of the transformer (7) therefore always appears the voltage of the same value, which may be further processed by traditional rectifier and stabilizer. In this way, the connection allows to transform the alternating voltage with wide range of input voltages where the primary voltage value is determined even before it is brought to the transformer primary winding and only subsequently it is transformed to the required value.



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Description

Background of the Invention

[0001] The invention deals with a connection of transformer power source with input voltage ranging within two limit values, which are rather distant from each other. The connection allows to transform alternating voltage within wide range of input voltages where the primary voltage value is determined even before it is connected to the primary winding of the transformer, thus eliminating possible overloading of the primary winding and current surges.

Description of Prior Art

[0002] For transformation of two different voltages with values rather distant from each other a transformer is usually equipped with multiple taps, which are switched from one to another by a servomotor. The servomotor must always start from the tap with the highest transformation ratio and proceed towards the tap with the lowest transformation ratio because otherwise the high voltage connected to the tap with low transformation ratio would cause a current surge and could result in the transformer damage. Another solution applies an array of relays, which suitably combine the taps on the primary winding so that they always proceed from the highest possible primary voltage to the lowest while monitoring whether the output voltage corresponds to required voltage. In many cases though only two different voltages are switched between, which however require very different transformation ratios of the transformer winding. Methods mentioned above mostly lead to costly and complex connection and high investments even in cases where the range of the input voltages is clearly defined but it is not clearly given when connecting to the distribution network.

Summary of the Invention

[0003] Disadvantages mentioned above are removed by the connection of transformer power source with wide input range according to the presented solution. Its principle is that it consists of the voltage converter where its output is connected to the input of the processor and further it consists of the auxiliary power supply source of direct voltage with wide range of input voltages where this range corresponds to the required parameters for the transformer power supply source and where its output is connected to the power supply input of the processor. Outputs of the processor are connected to control inputs of at least two switches. Inputs of the auxiliary source of direct voltage, voltage converter and the first switching contacts of switches are connected to the input voltage terminal. The second switching contacts of switches are connected to the transformer primary winding tap relevant for them. The output of the connection is the output terminals of the secondary winding. Switches may implement electromechanical relays or semiconductor switches with relevant parameters.

[0004] The connection presented herein removes the disadvantages of currently known solutions since it uses a circuit for evaluation of the incoming voltage by means of connection of a voltage converter and a processor, which resets when one of the limit voltages turns off and then the other limit voltage turns on, and subsequently it finds out from the output of the voltage converter what voltage is being brought to the power supply source input and accordingly it switches the relevant switch, thus selecting the corresponding primary winding of the transformer. Anytime a voltage is brought to the processor, the processor resets because it is supplied from the auxiliary source of voltage with wide range, which delivers only low direct power and whenever the voltage on the input voltage terminal is switched off, also the voltage on the processor is lost. As a result, on the transformer secondary side only the correct voltage or zero voltage may occur. Secondary voltage therefore does not fluctuate or rise-in gradually as in the case of transformers with servomotors or an array of tap switches. As opposed to the current state of the art this invention simplifies the conversion selection and implementation of the equipment in cases where only two primary voltages are to be switched between, even though their values may vary considerably.

Explanation of Drawings

[0005] Example of the connection of transformer power source with wide input range is shown by a block diagram in the attached drawing.

Detailed Description of the Preferred Embodiments

[0006] Connection of transformer power source with wide input range is shown in closer detail in the attached drawing as a block diagram. In order to provide clear understanding the connection is shown with two switches only - the first switch 5 and the second switch 6.

[0007] The connection consists of the voltage converter 3, with its output connected to the input of the processor 4, and of the auxiliary source 2 of the direct voltage with wide range of input voltages, which delivers necessary low power for the processor 4. Range of the input voltages of the auxiliary power source 2 is selected based on requirements for the transformer power supply source parameters. Output of the auxiliary source 2 of the direct voltage is connected to the power supply input of the processor 4. One output of the processor 4 is connected to the control input of the first switch 5 and the second output of the processor 4 is connected to the control input of the second switch 6. Inputs of the auxiliary source 2 of the direct voltage, of the voltage converter 3, the first switching contact of the first switch 5 and the first switching contact of the second switch 6 are connected to the

input voltage terminal 1. The second switching contact of the first switch 5 and the second switching contact of the second switch 6 are connected to the transformer 7 primary winding tap relevant for them. The output terminals 8 of the secondary winding are the output of the transformer power supply source.

[0008] When a voltage is brought to input voltage terminal 1, the auxiliary source 2 of direct voltage turns on and generates voltage that appears on the processor 4 thus resetting it to the initial state. During this state the signals controlling the first switch 5 and the second switch 6 are in the state that the contacts of the first switch 5 and the second switch 6 are open. Simultaneously, the voltage converter 3 converts the incoming voltage to the value acceptable by the processor 4, which measures this value and sends corresponding signal to close the first switch 5 or the second switch 6, and they connect the voltage on the terminal 1 to the corresponding tap on the transformer 7. On the output terminals 8 of the transformer 7 subsequently appears the corresponding output voltage. When the voltage on the terminal 1 disconnects and other voltage connects, the whole process repeats. Range of the input voltages is given by the requirements for the transformer power supply source with wide range of input voltages, where one of the voltages may be the extra low-voltage up to 50 V as defined by relevant standard, it means e.g. 24 V, and the second voltage may be within the range of low-voltages, i.e. from 50 V up to 1000 V, it means e.g. 230 V.

[0009] The connection may be modified for greater number of different voltages on the terminal 1 by modifying the voltage converter 3 and by changing the number of taps on the transformer 7 and the number of switches. Every additional switch is then connected to another output of the processor 4. The first switching contacts of the switches are connected to the input voltage terminal 1 and the second switching contacts of the switches are connected to other transformer 7 primary winding taps relevant for them. The switches may be realized as electromechanical relays or as semiconductor switches with relevant parameters.

[0010] The advantage of implementing this invention is less complex transformer design, saved space needed for installation, and eventually also lower costs of overall design and installation.

Industrial Applicability

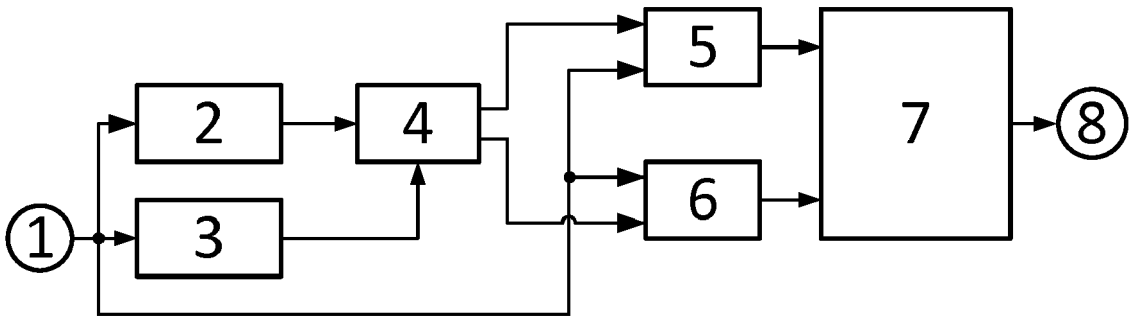
[0011] The invention may be implemented anywhere where alternating voltages of various values occur in the distribution network but the end-device requires to be supplied with the alternating voltage of specified value only that can change between the zero voltage state and the state with specified voltage and will not fluctuate due to switching between taps and gradual setting up to the correct value of the output voltage. An example can be the installation of an electronic unit in a distribution network where alternately occurs the low operational voltage 230 V and the extra-low protection voltage 24 V, while such electronic unit needs to be supplied with power in either case.

Claims

1. Connection of transformer power source with wide input range **characterized by the fact that** it consists of the voltage converter (3), the output of which is connected to the input of the processor (4), and of the auxiliary source (2) of the direct voltage with wide range of input voltages, which corresponds to the required parameters for the transformer power supply source, where the output of the auxiliary source (2) of the direct voltage is connected to the power supply input of the processor (4), while its outputs are connected to the control inputs of at least two switches (5, 6), and the inputs of the auxiliary source (2) of the direct voltage, of the voltage converter (3) and the first switching contacts of the switches (5, 6) are connected to the input voltage terminal (1), and the second switching contacts of the switches (5, 6) are connected to the transformer (7) primary winding tap relevant for them, while the transformer (7) output terminals (8) of the secondary winding are the output of the transformer power supply source.

2. Connection according to claim 1 **characterized by the fact that** the switches (5, 6) are electromechanical relays.

3. Connection according to claim 1 **characterized by the fact that** the switches (5, 6) are semiconductor switches.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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 September 2016	Arias Pérez, Jagoba

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 19 9276

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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