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**METHOD AND APPARATUS FOR MEASURING CHARACTERISTICS
OF A PLURALITY OF ELECTRICAL COMPONENTS**

BACKGROUND OF THE INVENTION

Field of the Invention

5 The present invention relates to a method and apparatus for measuring characteristics including at least insulation resistance, of a plurality of electrical components wherein the components are charged simultaneously and then simultaneously measured for
10 insulation resistance, and more particularly, though not exclusively, it relates to a method of measuring such insulation resistance values of electronic parts in a process of serially and intermittently carrying a plurality of electronic parts along a circulation path.

15 **Description of the Background Art**

 In advance of shipment of capacitors, for example, an inspection step is generally carried out for measuring electronic characteristics such as capacitance and insulation resistance, to select the capacitors on the
20 basis of the results of such measurement.

 A manufacturer shipping a large quantity of capacitors must efficiently carry out the aforementioned inspection step. Fig. 2 shows a characteristic measuring apparatus which is generally employed for measuring
25 the characteristics of chip capacitors, for example.

 Referring to Fig. 2, the characteristic measuring apparatus comprises a turntable 1, which is intermittently

fed along an arrow 2. In the periphery of the turntable 1, a plurality of holding portions 3 are distributed at regular intervals for holding chip capacitors one by one.

5 A parts feeder 4 is adapted to supply a plurality of chip capacitors. As the turntable 1 is intermittently rotated in the direction of arrow 2, the chip capacitors are successively supplied to the respective holding portions 3 one by one from a supply position 5.

10 The characteristics of the chip capacitors thus held by the holding portions 3 are measured in the following manner along intermittent feeding of the turntable 1.

First, capacitance values are measured at a capacitance measuring position 6.

15 Then, the chip capacitors are charged in a charge region 7. Thereafter insulation resistance values of the charged chip capacitors are measured in a measuring position 8. Then the charges stored in the chip capacitors are discharged in a discharge portion 9.

20 Thereafter the chip capacitors held by the holding portions 3 are selected on the basis of the results of the aforementioned characteristic measurement and taken out from an outlet position 13.

In the aforementioned method of measuring the characteristics, however, the chip capacitors are merely
25 intermittently charged in the charge region 7. This is

because charging terminals come into contact with the chip capacitors only when the turntable 1 is stopped, and no contact is attained between the charging terminals and the chip capacitors during rotation of the turntable 1. Thus, charging efficiency is so deteriorated that the chip capacitors may not be completely charged. As the result, it may not be possible to measure the insulation resistance values in high accuracy. In order to measure the insulation resistance values in high accuracy, the interval for intermittently feeding the turntable 1 must be increased. Thus, it is impossible to measure characteristics of a number of chip capacitors at a high speed. Such a tendency appears in the case of chip capacitors having particularly high capacitance values.

In order to attain a long charging time, the area of the charge region 7 may be increased. In this case, however, the size of the turntable 1 is unpreferably increased in view of area efficiency in the factory.

Further, since the charging time depends on the way of provision of the charge region 7, it is impossible to cope with characteristic measurement of various types of chip capacitors.

This also applies to measurement of insulation resistance of LC filters and the like in

addition to capacitors, while the characteristics to be measured may also include impedance and the like.

SUMMARY OF THE INVENTION

Accordingly, the present invention aims to
5 provide a method of measuring insulation resistance of electronic parts, which can solve at least some of the aforementioned problems.

The present invention is generally directed to a method of measuring characteristics of electronic
10 parts including at least insulation resistance.

According to one aspect of the present invention there is provided a method of measuring electrical characteristics, including insulation resistance, of a plurality of electrical components, said method comprising:
15 supplying said plurality of electrical components to a charging and measuring position; carrying out uninterrupted and simultaneous charging of said plurality of components; measuring the insulation resistance values of each of said charged electrical components simultaneously; and removing said plurality
20 of components from said charging and measuring position once their insulation resistance values have been measured.

According to another aspect of the present
25 invention there is provided a method of measuring characteristics of electronic parts including at least insulation resistance, said method comprising: providing a path for serially and intermittently

carrying a plurality of electronic parts; successively
supplying electronic parts to said path from a first
fixed position; stopping carriage of said electronic
parts upon arrangement of a prescribed number of said
5 electronic parts on said path for simultaneously
charging a plurality of said electronic parts and
thereafter without further movement simultaneously
measuring insulation resistance values thereof; and
selecting said electronic parts on the basis of said
10 insulation resistance values and drawing out the same
from said path at a second fixed position.

In an embodiment of the present invention, a
plurality of electronic parts are simultaneously
subjected to measurement of insulation resistance,
15 which necessarily requires at least a prescribed time
for accurate measurement, when carriage of the
electronic parts is stopped. Therefore, it is
possible to measure insulation resistance in high
accuracy without reducing measurement efficiency.
20 This feature is particularly advantageous for
electronic parts such as chip capacitors having high
capacitance values.

The charging time can be freely set in response
to the type of electronic parts whose characteristics
25 are measured. Therefore, it is possible to set an
optimum charging time with respect to each type of
electrical part as well as to measure characteristics
in the highest efficiency with respect to the type of

the electronic part.

According to a further aspect of the present invention there is provided an apparatus for measuring electrical characteristics including insulation resistance, of a plurality of electrical components, said apparatus comprising: supplying means for supplying said plurality of electrical components to a charging and measuring position of said apparatus; charging means for carrying out uninterrupted and simultaneous charging of said plurality of electrical components; measuring means for measuring the insulation resistance values of each of said electrical components simultaneously; and removing means for removing said plurality of electrical components from said charging and measuring position once their insulation resistance values have been measured.

The above and other features of the present invention are set forth with particularity in the appended claims and should become clearer from consideration of the following detailed description of an embodiment of the present invention when taken in conjunction with the accompanying drawings.

Brief Description of the Drawings

Fig. 1 is a plan view illustrating a characteristic measuring apparatus for carrying out an embodiment of the present invention; and

Fig. 2 is a plan view illustrating a conventional

characteristic measuring apparatus.

Detailed Description of the Embodiment

Fig. 1 is a characteristic measuring apparatus for carrying out an embodiment of the present invention. While this embodiment is adapted to measure characteristics of chip capacitors in particular, the present invention is also applicable to measuring the characteristics of LC filters and the like, and the characteristics to be measured may include capacitance, impedance and the like, in addition to insulation resistance.

The characteristic measuring apparatus comprises a turntable 21, similar to the conventional apparatus. This turntable 21 is intermittently rotated in the direction of arrow 22. In the periphery of the turntable 21, holding portions 23 are distributed at regular intervals for holding electronic parts of chip capacitors one by one therein. Therefore, the turntable 21 provides a circulation path for serially and intermittently carrying a plurality of chip capacitors.

Similarly in the conventional apparatus, the chip capacitors are supplied from a parts feeder 24, and are

successively fed from a fixed supply position 25 to the respective holding portions 23 one by one along intermittent feeding of the turntable 21.

While the turntable 21 is stepwisely fed to supply
5 the chip capacitors to the respective holding portions 23 as described above, those of the chip capacitors reaching a fixed capacitance measuring position 26 are subjected to measurement of capacitance values and those whose capacitance and insulation resistance values are
10 completely measured are selected and drawn out from the respective holding portions 23 in a fixed outlet position 27. Thus, no insulation resistance is measured during intermittent feeding of the turntable 21.

An insulation resistance measuring region 28 is
15 adapted to measure insulation resistance. When the insulation resistance measuring region 28 is filled up with those of the chip capacitors whose capacitance values have been measured upon a plurality of times of intermittent feeding, the turntable 21 is stopped for a
20 prescribed time. According to this embodiment, 27 holding portions 23 are distributed in the insulation resistance measuring region 28, so that 27 chip capacitors can be simultaneously located in the insulation resistance measuring region 28.

25 The 27 chip capacitors located in such an insulation

resistance measuring region 28 are simultaneously subjected to measurement of insulation resistance. Namely, the twenty-seven chip capacitors are simultaneously charged, simultaneously subjected to measurement of insulation resistance, and simultaneously discharged in successive charging, measuring and discharging steps. Such charging, measuring and discharging steps are preferably carried out while the chip capacitors are in contact with a common terminal. Therefore, the electric state of such a terminal is switched by a proper switching circuit.

When such measurement of insulation resistance is completed, intermittent feeding of the turntable 21 is again started. Along such intermittent feeding, the chip capacitors are selected and drawn out from the outlet portion 27, while new chip capacitors are supplied to the holding portions 23 from the supply position 25 to be subjected to measurement of capacitance in the capacitance measuring position 26.

An operation similar to the above is then repeated.

Although the turntable 21 provides a circulation path for serially carrying a plurality of chip capacitors in the aforementioned embodiment, such a circulation path may alternatively be provided by an endless belt, for example.

Further, the capacitance measuring position 26 and the insulation resistance measuring region 28 may be reversed in order.

Having thus described the invention by reference to a particular embodiment, it is to be appreciated that the described embodiment is exemplary only and is susceptible to modification and variation without
5 departure from the scope of the invention as determined by the appended claims.



CLAIMS:

1. A method of measuring electrical characteristics, including insulation resistance, of a plurality of electrical components, said method comprising:

5 supplying said plurality of electrical components to a charging and measuring position;

carrying out uninterrupted and simultaneous charging of said plurality of components;

10 measuring the insulation resistance values of each of said charged electrical components simultaneously; and

removing said plurality of components from said charging and measuring position once their insulation resistance values have been measured.

15 2. A method of measuring characteristics of electronic parts including at least insulation resistance, said method comprising:

providing a path for serially and intermittently carrying a plurality of electronic parts;

20 successively supplying electronic parts to said path from a first fixed position;

stopping carriage of said electronic parts upon arrangement of a prescribed number of said electronic parts on said path for simultaneously charging a plurality of said electronic parts and thereafter
25 without further movement simultaneously measuring insulation resistance values thereof; and



selecting said electronic parts on the basis of said insulation resistance values and drawing out the same from said path at a second fixed position.

3. A method in accordance with claim 2, wherein said
5 electronic parts comprise chip capacitors and said characteristics include capacitance, in addition to said insulation resistance.

4. A method in accordance with claim 3, wherein the
10 measuring of insulation resistance values includes charging said chip capacitors, measuring insulation resistance values of charged said capacitors, and discharging measured said capacitors, said charging, measuring and discharging being carried out while said capacitors are in contact with a common terminal.

15 5. A method in accordance with claim 3 or 4, said method further comprising:

carrying said chip capacitors along said path and measuring capacitance values thereof in a third fixed position.

20 6. A method in accordance with any of claims 2 to 5, wherein said path is a circulation path and is provided by a turntable.

7. An apparatus for measuring electrical character-



istics including insulation resistance, of a plurality of electrical components, said apparatus comprising:

supplying means for supplying said plurality of electrical components to a charging and measuring position of said apparatus;

charging means for carrying out uninterrupted and simultaneous charging of said plurality of electrical components;

measuring means for measuring the insulation resistance values of each of said electrical components simultaneously; and

removing means for removing said plurality of electrical components from said charging and measuring position once their insulation resistance values have been measured.

8. A method substantially as herein described with reference to Figure 1 of the accompanying drawings.

9. An apparatus substantially as herein described with reference to Figure 1 of the accompanying drawings.