Feb. 19, 1957 L. A. McCARTHY 2,782,368

CALIBRATING MACHINE

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FIG 5

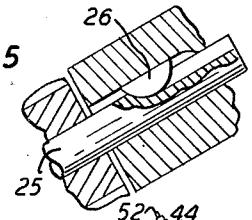


FIG 1

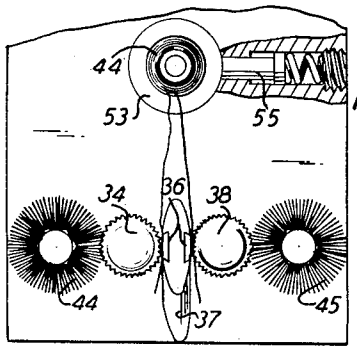
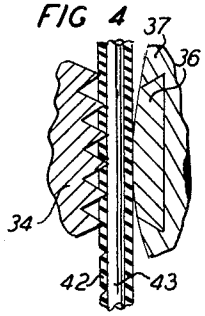


FIG 2

FIG 4



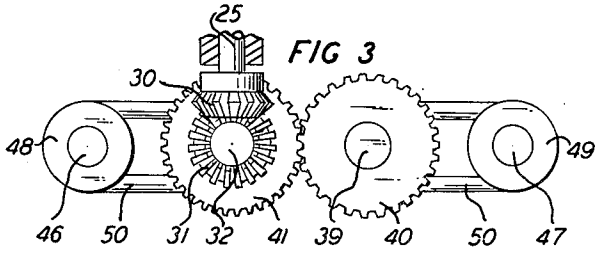


FIG 3

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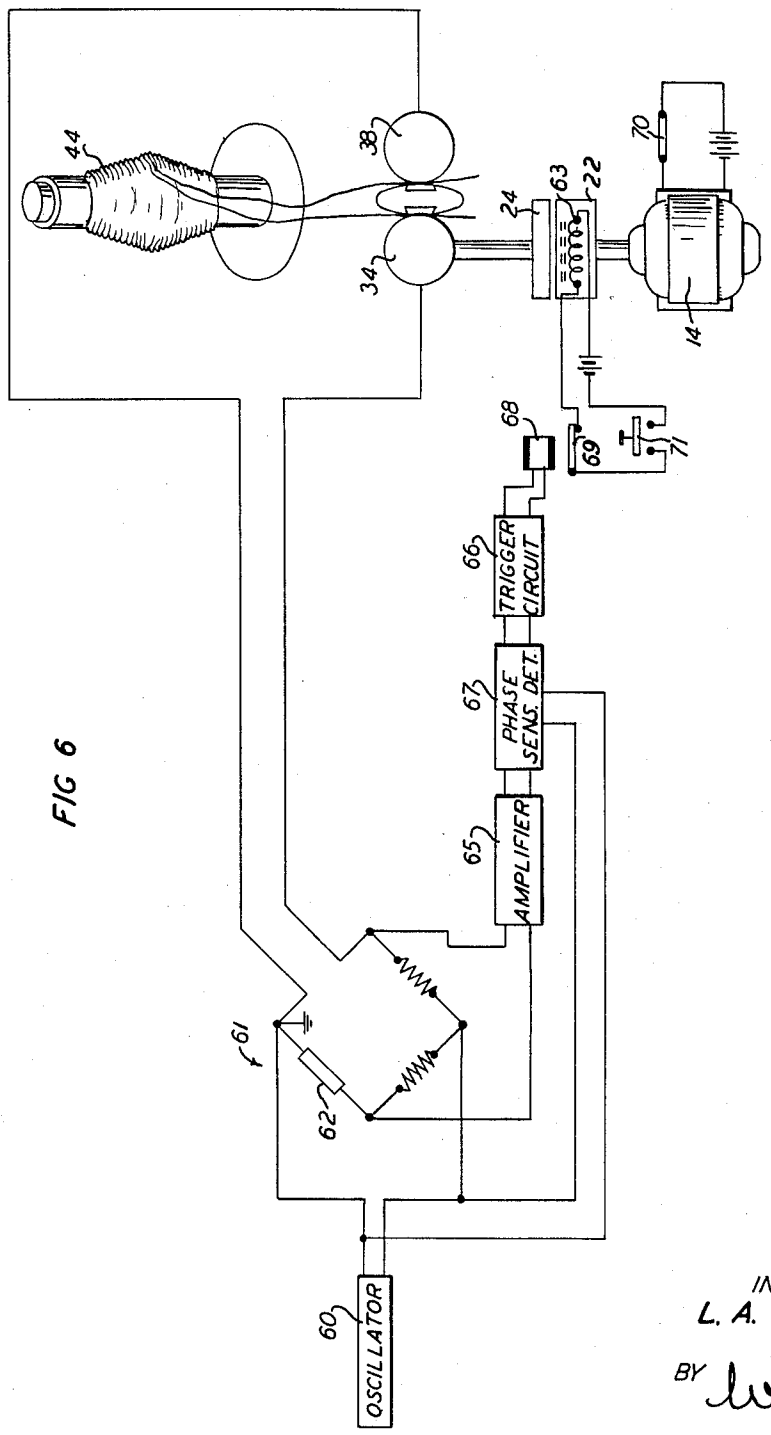


FIG 6

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CALIBRATING MACHINE

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2 Claims. (Cl. 324—62)

This invention relates to the manufacture of electrical units such as coils or wire wound resistors and it is particularly concerned with the problem of adjusting the electrical characteristics of the units to a desired value.

When, for example, coils or resistors must be made to standard values of inductance or resistance within very close limits, it is sometimes impracticable to obtain a required high degree of uniformity by the usual expedients of winding measured lengths of wire or counting the turns as they are applied. In such cases the units may be machine wound approximately to the desired values and later measured and adjusted individually by adding or removing turns as required.

The object of this invention is to simplify and expedite this adjusting procedure.

With this and other objects in view the units are wound so that they all deviate in the same direction from the desired value preferably, in most cases, by winding on excess turns sufficient in number to insure that the impedance of all the units will be slightly high. Each unit is then adjusted to the desired value by apparatus which removes the excess wire while the unit is connected into a measuring circuit in which the value of the characteristic of interest is continuously compared with a known value. When sufficient wire has been removed to reduce the characteristic of the unit to the desired value the apparatus is stopped under the control of the comparison circuit to indicate the point at which the wires must be cut off.

The comparison circuit may consist essentially of an alternating current bridge in which one arm is a unit under test and another arm is an element having a known value of resistance or other characteristic of interest. The wire unwinding mechanism may comprise a roller or rollers connected to the bridge and driven through a clutch automatically disengaged when the bridge unbalance voltage reaches the value corresponding to the desired value of the unit being tested. The rollers are serrated to puncture the insulation as the wire passes over the roller so that the portions of wire unwound are automatically removed from the measuring circuit.

Other objects and advantages will be apparent from the following detailed description when considered in conjunction with the accompanying drawings, wherein:

Fig. 1 is a side elevational view of the apparatus portions thereof being shown in section;

Fig. 2 is a top plan view of the front or left portion of the apparatus shown in Fig. 1;

Fig. 3 is a fragmentary detailed view illustrating the driving means for the serrated rollers and brushes shown in Fig. 2;

Fig. 4 is an enlarged fragmentary sectional view illustrating the effect of the serrated rollers on the insulated wire of the coil;

Fig. 5 is a fragmentary sectional view illustrating the key connection between the adjacent clutch member and shaft, and

Fig. 6 is a schematic illustration of the apparatus and the control circuits therefor.

The apparatus shown in Fig. 1 includes a suitable base 10 having a surface 11 disposed at an angle with respect to the main supporting surface 12 to receive and support the various parts of the apparatus. In the present embodiment of the invention, the power means for the apparatus includes a motor 14 which is driven constantly during use of the apparatus. A speed reducing unit 15 has its input shaft 16 connected to the motor shaft 17 and its output shaft 19 connected to a shaft 20 journalled in a suitable bearing 21. A main, or coil bearing member, 22 of an electromagnetic clutch indicated generally at 23 is mounted on the lower end of the shaft 20. The other member 24 of the clutch 23 is disposed on the adjacent end of a shaft 25 and connected to the shaft by a key 26 whereby the clutch member 24 may move by gravity, or any other suitable means, axially of the shaft 25 away from the clutch member 22 but will serve to positively drive the shaft 25 when the clutch 23 is energized.

The shaft 25 is mounted in a suitable bearing 28 disposed in a housing 29 formed of suitable material and mounted on the surface 11 of the support 10. The inner end of the shaft 25 has a bevelled gear 30 mounted thereon which interengages a bevelled gear 31 mounted on a shaft 32. The shaft 32 is journalled in a suitable bearing 33 supported in the housing 29 and has a serrated roller 34 mounted on the upper or outer end of the shaft. The serrations of the roller 34 are parallel with the axis of the shaft 33 and co-operate with one of a pair of wear-resistant members 36 removably disposed in dove-tailed slots of a spacing element 37. The spacing element is mounted on the housing 29 and with its wear-resistant members 36, is interposed between the serrated roller 34 and a like serrated roller 38. The roller 38 is mounted on a shaft 39, journalled in a bearing similar to the bearing 33 disposed in the housing 29, and operatively connected to the shaft 32 by gears 40 and 41 as illustrated in Fig. 3.

The purpose of each serrated roller during rotation thereof is to have their serrations successively cut into the insulation 42 of a wire 43 from an electrical unit 44. To remove any particles becoming lodged in the hollow portions of the serrated surfaces of the wheels 34 and 38, rotary brushes 44 and 45 are mounted on spindles 46 and 47 which carry grooved pulleys 48 and 49 for operative connection with like pulleys mounted on their respective roller shafts 32 and 39 by the aid of belts 50 and 51 to cause rotation of the brushes during rotation of the serrated rollers.

In the present embodiment of the invention the electrical unit 44 is commercially known as a non-inductive resistance unit composed of a tubular core having a predetermined number of pairs of turns of a single wire doubled at the start of its wind and terminating in two leads. The convolutions wound on the core are greater in number than that necessary to establish a given value. The unit 44 is removably mounted on a spindle 52 which is supported for rotation in a bearing 53 mounted in the housing 29. A suitable brake illustrated as a spring-pressed plunger 55 is positioned to engage the inner portion 56 of the spindle 52 to create a given tension in the wires or portions of the wire removed from the core. Similar brakes (not shown) are provided for the roller shafts 32 and 39 to stop them the moment the electromagnetic clutch is de-energized.

Attention is now directed to the schematic illustration of the apparatus shown in Fig. 6 which includes a suitable control circuit whereby the removal of wire from the unit 44 may be stopped the moment the electrical characteristics of the unit bears a pre-determined relation to a standard in a bridge circuit. To illustrate this control means reference numeral 60 designates a suitable oscillator for a bridge indicated generally at 61 which has a

given standard 62 in one arm thereof, its value depending on the particular type of unit being conditioned and the known value desired for the units. As illustrated in Fig. 6, the serrated rollers 34 and 38 are included in another arm of the bridge circuit and in this manner the convolutions of the present coil type unit 44 are included in the bridge circuit. Extending from the bridge circuit are the necessary circuits and units to cause de-energization of a winding 63 in the member 22 of the electromagnetic clutch the moment the impedance of the unit 24 bears a pre-determined relation to the standard 62. These units may include an amplifier 65, a suitable phase sensitive detector 67 and a trigger circuit 66 including a gaseous discharge tube which fires and operates a relay 68 to open the normally closed contact 69 in the circuit to the electromagnetic clutch 63.

Considering now the present embodiment of the invention, let it be assumed that the motor 14 is energized and that a unit 44 is mounted on its spindle 52 with the wires or ends of the double wire 43 positioned between their respective serrated rollers 34 and 38 and the adjacent elements 36. The moment the wires or leads are inserted in the apparatus, the adjacent serrations of the rollers 34 and 38 will cut through the insulation to include the remaining convolutions of the unit 44 in the bridge circuit 61. By closing a switch 70 in the motor circuit the motor 14 is energized and by closing a switch 71 in the clutch circuit the clutch 63 is energized to drive the serrated rollers simultaneously. This operation will cause continuous removal of wire from the coil of the unit causing its electrical resistance to approach the value of the standard 62.

Since the resistance of the units is initially too high the bridge will be unbalanced and this unbalance potential is amplified and impressed on the detector 67 along with a reference potential derived directly from the source 60. The rectified output of the detector under this condition is of such polarity that it does not fire the trigger circuit 66 and the relay 68 remains unoperated. As the removal of wire from the unit 44 progresses, the bridge passes through the balanced condition and becomes unbalanced in the other direction. When this occurs the polarity of the unbalance potential reverses and the output of the detector is then of the proper polarity to trigger the circuit 66 and operate the relay 68 to stop the apparatus. With the amplifier 65 set for high gain this will occur at a very small value of unbalance potential and hence the resistance of the coil as measured between the last serrations on the wire will be very nearly equal to the resistance of the standard. When very high accuracy is required the value of the standard 62 may be chosen to compensate for the value of unbalance potential required to operate the circuit. Obviously the wire removed from the coil will be collected in such a way that it does not short circuit the coil being tested.

While the invention has been described with particular reference to adjusting non-inductively wound resistors, it is readily adaptable to other uses. In adjusting the inductance of coils, for example, the standard 62 of the bridge will, of course, be an inductance of the proper

value. In that case only one lead is unwound and hence only one serrated roll is required and the inner end of the coil will be connected directly to the bridge.

In some cases as, for example, when bare wire is to be wound in an open spiral, the apparatus may be adapted to operate in connection with the initial winding operation. In these cases the initial value of the impedance component of interest will be low and premature operation of the trigger circuit is prevented by reversing one pair of the connections to the phase sensitive detector 67. The shaft 25 will, of course, be connected to drive the winding arbor and the contacting rollers are driven by the advancing wire.

It is to be understood that the above described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. An apparatus for comparing the impedance of prewound insulated wire coil type impedance units, having excess turns of insulated wires therein, with a given standard in a bridge circuit, the apparatus comprising means to rotatably support a prewound impedance unit, a rotatable element having teeth adapted to bite successively through the insulation and electrically engage the wire of the excess turns of the unit to include the unit in the bridge circuit, power means energizable to rotate the element to cause it to remove the insulated wire at a given rate from the coil unit until the impedance of the coil unit bears a predetermined relation to the standard, and means actuable when said relation to the standard is reached to cause de-energization of the power means and stopping of the element at the position where the excess insulated wire is to be cut from the unit.

2. An apparatus for comparing the impedance of prewound multiple insulated wire coil type impedance unit, having excess turns of the multiple wires therein, with a given standard in a bridge circuit, the apparatus comprising means to rotatably support the prewound impedance unit, rotatable elements having teeth adapted to bite successively through the insulation and electrically engage their respective wires of the excess turns of the unit to include the unit in the bridge circuit, power means energizable to rotate the elements simultaneously to cause them to remove the insulated wires at a given rate from the coil unit until the impedance of the coil unit bears a predetermined relation to the standard, and means actuable when said relation to the standard is reached to cause de-energization of the power means and stopping of the elements at the positions where the excess portions of the insulated wires are to be cut from the unit.

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