F. E. RICKETTS.

TESTING APPARATUS.

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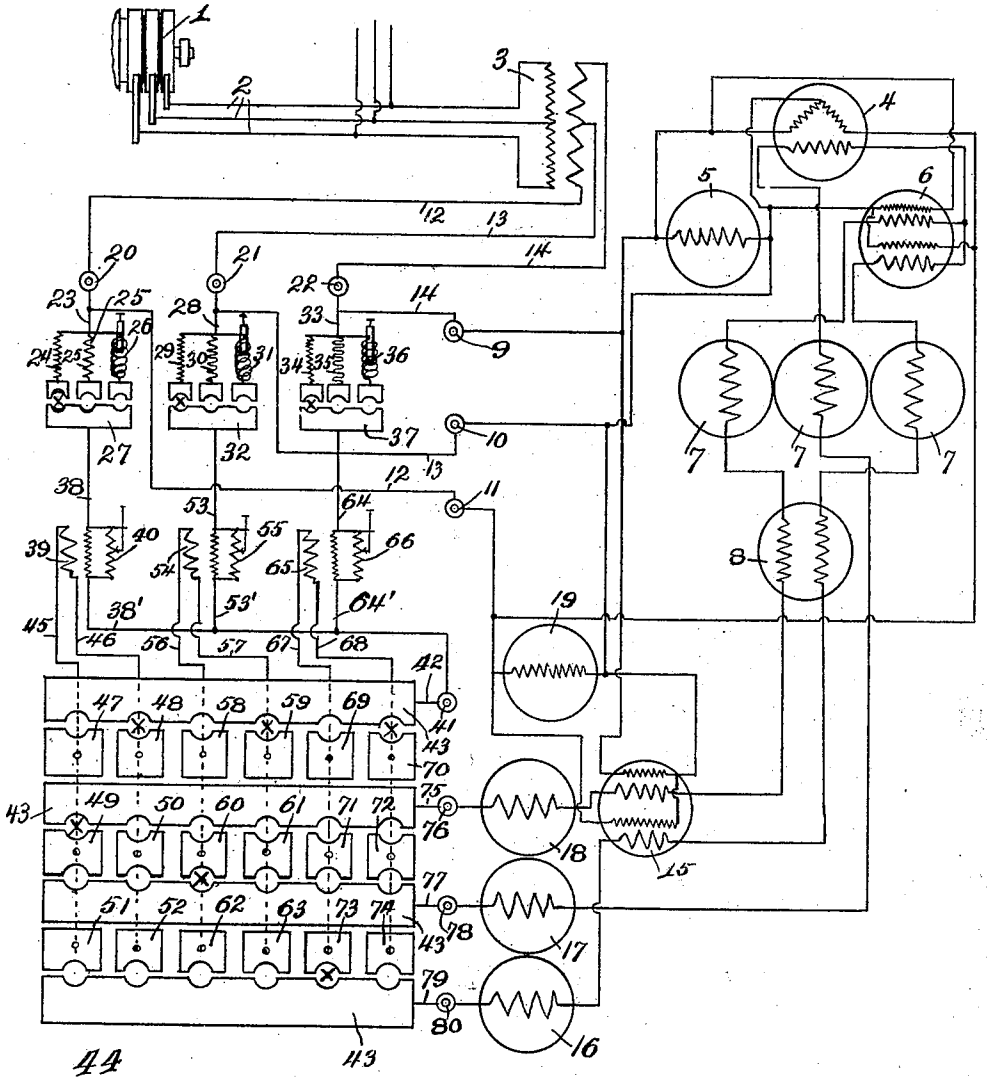
920,652. Patented May 4, 1909.



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TESTING APPARATUS.

No. 920,652. Specification of Letters Patent. Patented May 4, 1909.

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To all whom it may concern:

Be it known that I, FORREST E. RICKETTS, citizen of the United States, residing at Baltimore, in the county of Baltimore City and State of Maryland, have invented certain new and useful Improvements in Testing Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates particularly to testing apparatus especially adapted for supplying currents for testing polyphase or single-phase instruments.

The object in view is the provision of means for testing all of the instruments on the panel at a given power station over their entire scale and tripping the relay from overload that is shifting the circuit protecting element by the supplying of only a comparatively few watts, whereby a material saving is effected over the usual testing methods which involve, for the same test, the utilization of several hundred watts.

The figure of the drawing is an outline conventional showing of one embodiment of the present invention illustrated in testing relation to a set of instruments to be tested.

Referring to the drawing by numerals, 1 is a polyphase generator and 2 the bus leading therefrom to the transformers 3. Transformers 3 are of relatively small capacity, being of the switchboard type. The power plant panel is provided with the usual power factor indicator 4, volt-meter 5, watt-meter 6, ammeters 7, 7, 7, and relay 8, all connected in the usual manner through binding posts 9, 10 and 11 by conductors 12, 13 and 14 with the secondaries of transformers 3. The standardizing instruments or instruments by which the instruments above mentioned, belonging to the generator, are checked may consist of a watt-meter 15, ammeters 16, 17 and 18, and volt-meter 19, or if the testing set is being operated at unity power factor, that is if no inductive load is in circuit, the watt-meter 15 may be omitted. These checking or standardizing instruments and the instruments belonging to the generator obviously are such as may be present in any modern power station, and therefore do not constitue a part of the present invention.

Interposed in the length of the conductors 12, 13 and 14 are binding posts 20, 21 and 22 respectively. A conductor 23 extends from binding post 20 and is connected to non-inductive resistances 24 and 25 and to variable, inductive resistances 26, the said resistances being connected with the three insulated blocks of a plug switch 27. A conductor 28 leads from the binding post 21 and is connected to non-inductive resistances 29 and 30 and with variable, inductive resistance 31, said resistances 29, 30 and 31 communicating with the three insulated blocks of a plug switch 32. A conductor 33 extends from the binding post 22 and communicates with non-inductive resistances 34 and 35 and variable, inductive resistance 36, said resistances 34, 35 and 36 connecting with the three insulated blocks of plug switch 37.

The switch 27 is provided with a conductor 38 which communicates with the primary of transformer 39, and is also in parallel with a variable resistance 40. The opposite side of the primary of transformer 39 and the resistance 40 from the conductor 38 is connected by conductor 38′ with binding post 41, which binding post is connected by conductor 42 with one of the ground plates 43 of a plug switch 44. The opposite sides of the secondary of transformer 39 are connected by conductors 45 and 46 to the insulated blocks 47, 48 respectively, and similarly connected to blocks 49 and 50 respectively and 51 and 52 of plug switch 44, each of said blocks being adapted to be plugged into electrical communication with one or more of the ground plates 43 of said plug switch.

Leading from the switch 32 is a conductor 53 which is connected in parallel with the primary of transformer 54 and variable resistance 55, the opposite side of the said resistance and of the primary of transformer 54 being connected by conductor 53′ to conductor 38′. The secondary of transformer 54 has its opposite sides connected by conductors 56 and 57 to insulated blocks 58 and 59 respectively, and similarly connected to blocks 60 and 61 respectively, and to blocks 62 and 63 respectively of plug switch 44.

The switch 37 is provided with a conductor 64 connected in parallel to the primary of transformer 65 and variable resistance 66, the opposite side of said resistance and of the primary of said transformer being connected to conductor 64′ communicating with the conductor 38′. The opposite sides of the secondary of transformer 65 are connected by conductors 67 and 68 to the insulated blocks 69 and 70 respectively, and similarly

to blocks 71 and 72 respectively and to blocks 73 and 74 respectively of plug switch 44.

The second ground plate 43 is provided with a conductor 75 extending to a suitable binding post 76 which in operation is connected with ammeter 18 and with watt-meter 15 if the standard power factor is not unity. The third ground plate 43 is provided with a conductor 77 extending to a binding post 78 connected with ammeter 17. The fourth or last ground plate 43 is provided with a conductor 79 extending to a binding post 80 connected with ammeter 16.

It is to be observed that the switches 27, 32 and 37 with their resistances together with the transformers 39, 54 and 65, and resistances 40, 55 and 66 may be placed in a suitable casing with the plug switch 44, so as to be readily transported, and these last mentioned parts constitute the essential features of the present invention, and the same obviously may be varied in their combination with the standardizing instruments, as found best adapted for testing purposes.

For the sake of disclosing one practical operation of the present invention as illustrative of the utility of the invention, it is to be observed that when the contacts are closed on the plug switch 44 by plugs indicated at X on said switch, that is the first ground plate 43 being in electrical connection with conductors 46, 57 and 68, and the second ground plate 43 being in electrical communication with conductor 45, the third ground plate being in electrical communication with the conductor 56, and the fourth ground plate being in electrical connection with conductor 67, and the ground plate of each of switches 27, 32 and 37 being connected respectively with resistances 24, 29 and 34, three-phase current will flow through the binding posts 20, 21 and 22, current of the first-phase passing from post 20 through resistance 24, through switch 27, through primary of transformer 39 and through primary of transformer 54 to switch 32, and through resistance 29 to post 21. Current of the second-phase will enter post 21 and leave post 22, passing through resistances 29 and 34 and primaries of transformers 54 and 65, and current of the third-phase will enter post 20 and leave post 22 passing through the resistances 24 and 34, and the primaries of transformers 39 and 65. Obviously in referring to the primaries of transformers 39, 54 and 65, the resistances 40, 55 and 66 respectively should be considered as the current will flow therethrough in whole or in part according to the adjustment of the particular resistance. It is to be noted that an essential feature of the present invention resides in the adjustability of the resistances 40, 55 and 66 which makes it possible to vary the current through the primaries of transformers 39, 54 and 65. The resistance 40, for instance may be adjusted to no resistance, and thus draw all the current from line 38 and reduce the current in the secondary of transformer 39 to zero. It is obviously true also with respect to transformers 54 and 65, and by gradually increasing the resistances the current in the secondaries of said transformers may be gradually increased as may be desired, and as the currents from said secondaries flow from binding posts 76, 78 and 80 the instruments may be caused to read as if in actual operation, and thus the instruments to be tested may be checked by the standard instruments over their entire scale and the relay also operated. This effects a very material saving in the test over the use of an actual load and reduces the amount of energy expended in a test from that represented by several hundred watts, required for the usual testing operation, to that represented by only a few watts required for a test when employing the present invention.

It is to be observed that resistances 24, 29, and 34 and 25, 30 and 35 are non-inductive and are to be used for testing at unity power factor, that is when there is no lag of current. If the test is to be made with a standard power factor of any given lag the inductive resistances 26, 31 and 36 will be used instead of the non-inductive resistances. Obviously the resistances 26, 31 and 36 are variable for varying the lag of current as desired.

Resistances 24, 25 and 26; 29, 30 and 31; and 34, 35 and 36 are of relatively high resistance, and the primaries of the transformers 39, 54 and 65 are relatively low, so that the resistances 24, 25, etc., represent substantially the entire load, and the supply transformer 3 would thus not be burned out if the circuits were short circuited across the primaries of transformers 39, 54 and 65, and the comparatively small amount of current supplied to said primaries may be readily varied by adjustment of the resistances 40, 55 and 66.

What I claim is:—

1. In a testing apparatus, the combination of a transformer, a variable inductive resistance in series with the primary thereof for varying the lag of current supplied to such primary, a variable non-inductive resistance in parallel with such primary for varying the amount of current supplied thereto, and instrument connections for the secondary of said transformer.

2. In a testing apparatus, a transformer, a variable resistance in parallel with the primary thereof, and connections with the secondary of the transformer for the standardizing instruments and instruments to be standardized.

3. In a testing apparatus, the combination of a transformer, a variable inductive resistance, and a variable non-inductive re-

sistance, one of said resistances being in series with the primary of the transformer and the other in parallel therewith, and instrument connections for the secondary of the transformer.

4. In a testing apparatus, a variable inductive resistance, a transformer having its primary connected therewith, and a variable resistance in parallel with said primary.

5. In a testing apparatus, a non-inductive resistance, an inductive resistance in parallel therewith, a transformer, a switch for establishing connection between the primary of the transformer and either of said resistances and a plug switch for the secondary of the transformer.

6. In a testing apparatus, a non-inductive resistance, a variable, inductive resistance in parallel therewith, a transformer, a switch for establishing connection between the primary of the transformer and either of said resistances and a plug switch for the secondary of the transformer.

7. In a testing apparatus, the combination of a transformer, a variable non-inductive resistance in parallel with the primary of said transformer, a non-inductive resistance and an inductive resistance in series with said primary, whereby the resultant current supplied to said primary may be varied in intensity and phase relation relative to that of the supplied voltage, and instrument connections for the secondary of said transformer.

8. In a testing apparatus, the combination of a transformer, a variable non-inductive resistance in series with the primary of the transformer, a variable inductive resistance in series with the primary of said transformer and adapted for varying the lag of current supplied to said primary, a variable resistance in parallel with said primary, and instrument connections for the secondary of said transformer.

9. In a polyphase testing apparatus, a plurality of transformers, and a variable resistance for each connected in parallel with the primary thereof, and instrument connections for the secondaries of all of said transformers.

10. In a polyphase testing apparatus, a plurality of transformers, means for varying the current in the primaries thereof, and instrument connections for said secondaries adapted for adjustment for varying the phase relations of current supplied from said connections.

11. In a polyphase testing apparatus, a plurality of transformers, means for varying the current of the primaries thereof, a plug switch connected to the sides of the secondaries of the several transformers, and instrument connections for said plug switch, said plug switch being arranged and adapted to receive plugs in various positions and relations for varying the phase relations of current supplied from said instrument connections.

12. In a testing apparatus, a non-inductive resistance, a variable inductive resistance in parallel therewith, a transformer, a switch for establishing connection between the primary of the transformer and either of said resistances, a variable resistance connected in parallel with said primary, and instrument connections for the secondary of said transformer.

In testimony whereof I affix my signature in presence of witnesses.

FORREST E. RICKETTS.

Witnesses:

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