

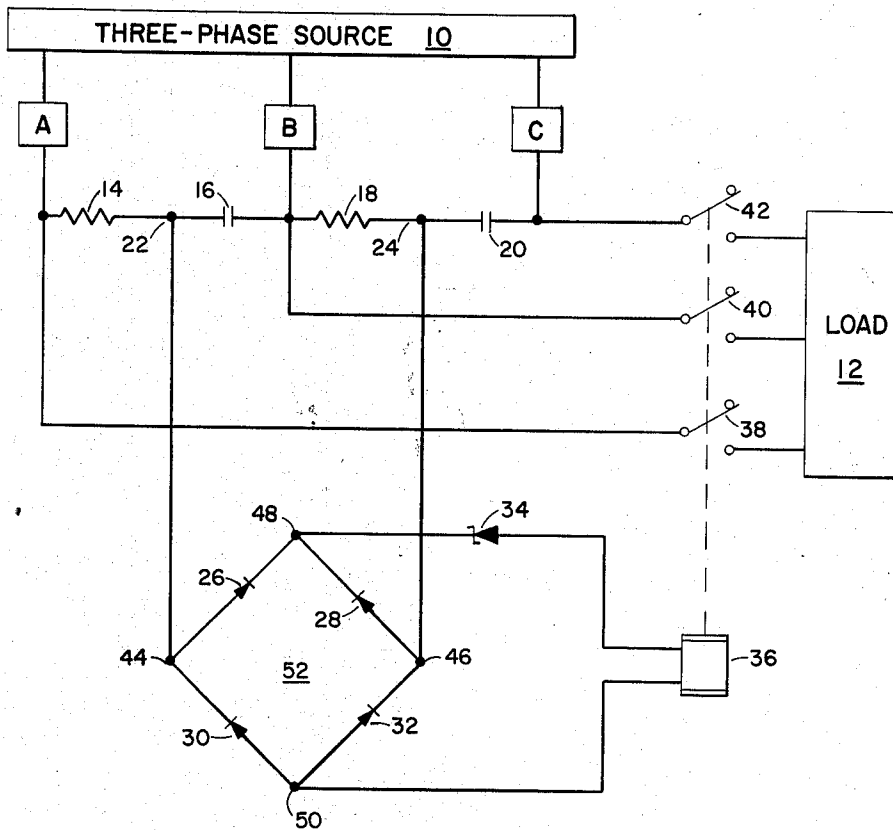
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AUTOMATIC SWITCH CONTROLLER

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AUTOMATIC SWITCH CONTROLLER

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The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment of any royalty thereon.

The present invention relates generally to control devices and specifically to a device for selectively connecting a polyphase source to a load.

Generally, in an unbalanced polyphase system, a reversal of phase sequence will cause certain branch currents to change in magnitude as well as in time-phase position. Also, any substantial decrease in value or the complete removal of one or more of the phase voltages will cause a change in the magnitude of certain branch currents. Therefore, if the phase sequence and voltage magnitudes of three phase sources do not correspond to a particular load, damage may result in the circuit when a connection is made therebetween. A hazard also exists if, after the source is connected to the load, a drop in or complete removal of one or more of the phase voltages occurs. These problems and conditions can be determined by the use of test equipment to measure the value of each phase voltage and check the phase sequence, however, human error and the time consumed in determining these conditions has established a need for an automatic switch controller. Prior controllers also have disadvantages in their operation which restrict or prohibit their use in many circuits and applications; the most critical being the high power consumption required. Relatively high power consumption is, of course, undesirable, especially in the missile field where power requirements must be kept at a minimum. In addition, construction of prior devices is expensive and delicate and because of their high degree of sensitivity they must have considerable protection, for instance, by completely enclosing them with potting compound.

It is, therefore, an object of this invention to provide a device for making a connection from a source to a load in a three-phase circuit only when the phase is in proper sequence.

It is a further object of this invention to provide a device for making the connection only when all phase voltages are present and at the correct value for proper operation of the load.

It is another object of this invention to provide an automatic connection controller which will have low power consumption.

It is also an object of this invention to provide an automatic connection controller which will be inexpensive to construct, insensitive to outside factors, and of durable construction and design.

These and other objects may be attained by providing in a three-phase circuit, a pair of impedance legs connected in shunt between the lines to provide a switching voltage to a switching means if all conditions of the source are favorable to the load and to provide a non-switching voltage to the switching means if one or more conditions of the source are unfavorable.

The invention, however, will be more fully understood and realized from the following detailed description, when taken in conjunction with the accompanying drawing, in which is shown a schematic diagram of the invention.

Referring to the drawing a three-phase power source 10 is connected to terminals A, B, and C, and the resultant phase voltages between the terminals differ by one-third

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cycle. In the following description each phase voltage will be designated by the letters of the terminals between which they are connected and the phase sequence will be designated by all three voltages listed in sequential order.

In the drawing, a resistor 14 and capacitor 16 are connected across voltage AB and a resistor 18 and capacitor 20 are connected across voltage BC. If the phase sequence of source 10 is AB-BC-CA and the magnitude of each phase voltage is of sufficient value, a relatively large potential will develop between points 22 and 24. However, if the phase sequence is AB-CA-BC, any phase voltage is reduced in value, any phase voltage removed, or any combination of the latter three conditions, a relatively small potential will develop between points 22 and 24. A full-wave rectifier bridge 52 consisting of diodes 26, 28, 30, and 32 has its input terminals 44 and 46 connected respectively to points 22 and 24. A Zener diode 34 is connected in series with a relay 36 between positive output terminal 48 and negative output terminal 50. Before conduction can occur from terminal 48 to terminal 50 thru relay 36, the Zener voltage must be exceeded, and if the relay is to be actuated, the voltage must be at least equal to the voltage drop across the Zener diode and the relay. Therefore, if the conditions of the source are favorable, relay 36 will be actuated to close contact switches 38, 40, and 42. However, if the conditions are not favorable, the contact switches will remain open or will open if previously closed.

In one particular test of the present invention in which satisfactory results were attained, the following values were employed:

Three-phase source—115 volts, 400 cycles each phase.

Resistor 14—7,000 ohms

Resistor 18—5,000 ohms

Capacitor 16—0.1 mfd.

Capacitor 20—0.05 mfd.

Zener diode 34—60-volt Zener effect

Relay 36—12,000 ohms, 28 v. D.C.

It is understood, of course, that the present invention should not be restricted to the above mentioned values. Other ramifications of the present invention may include various combinations of impedances connected between the sources. If, for instance, it is desired to achieve a greater differential in voltage between points 22 and 24, the capacitive reactance may be increased. Also, an inductance may be included in each line with the resistors and the capacitive reactance varied accordingly to achieve the desired performance and results. Many other applications and modifications will be suggested from the principles of the specific exemplification and it is accordingly desired that in construing the breadth of the appended claims, they shall not be limited to the specific details shown and described herein.

I claim:

1. A device for selectively connecting a three-phase source to a load wherein said source includes individual phase voltages having a predetermined phase sequence; said device comprising circuit means connected in shunt with said three phase source for providing a potential responsive in magnitude to the phase sequence and magnitudes of the phase voltages, switching means for connecting the source to the load and connecting means for connecting the switching means to the circuit means whereby the switching means operates in response to a predetermined magnitude of the potential.

2. A device as in claim 1 wherein said circuit means includes a pair of resistors and a pair of reactance elements, one of said resistors and one of said elements connected in series between a first and second phase voltage source, other of said resistors and other of said elements connected in series between a second and third phase voltage source.

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3. A device as in claim 2 wherein said switching means includes rectifier means for providing a rectified signal responsive to the potential, contact switches connected between the source and the load, and relay means connected to said rectifier means for operation of said contact switches responsive to the magnitude of the rectified signal.

4. A device as in claim 3 wherein said rectifier means includes a positive and negative output terminal and provides the rectified signal positive to negative respectively, said relay means includes a Zener diode having the cathode connected to said positive terminal and a relay coil connected in series between the anode of said Zener diode and said negative terminal and disposed for actuation responsive to the rectified signal, the operation of said contact switches being responsive to the actuation of said coil.

5. A device as in claim 2 wherein each of said reactance elements includes a capacitor, one of said capacitors and said other resistor being connected to the second phase voltage source, said one resistor being connected to the first phase voltage source, and other of said capacitors being connected to the third phase voltage source.

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6. A device as in claim 5 wherein said switching means includes a full-wave rectifier having a pair of input terminals and positive and negative output terminals; one of said input terminals connected to the connection of said one resistor and capacitor; other of said input terminals connected to the connection of said other resistor and capacitor; a Zener diode having an anode and a cathode; a relay coil; said positive terminal connected to said cathode, said anode connected thru said relay coil to said negative terminal; contact switches connected between the source and the load and disposed for operation responsive to the actuation of said coil.

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