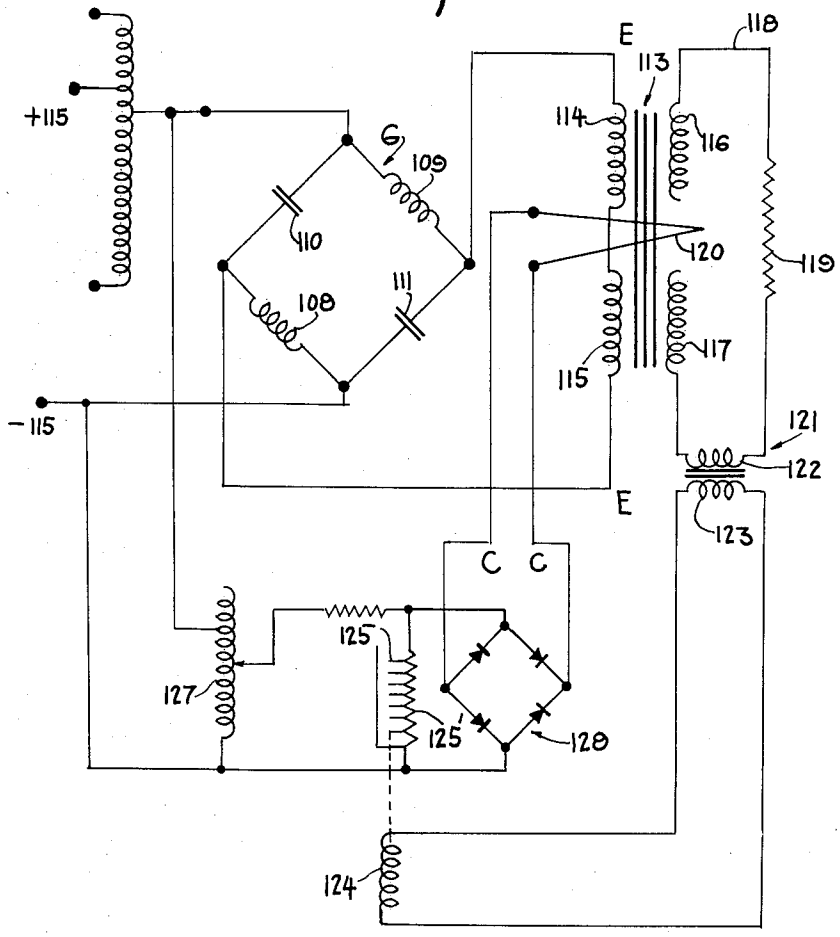
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ELECTRICAL SYSTEM FOR COMPENSATING FOR LINE VOLTAGE VARIATIONS

Original Filed May 14, 1954

Fig. 1



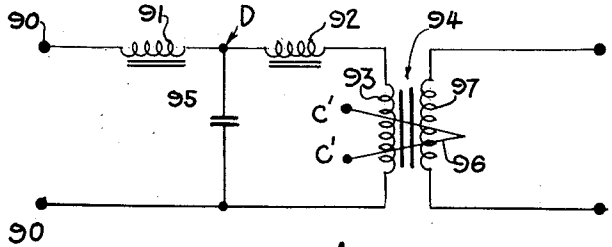


Fig. 2

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ELECTRICAL SYSTEM FOR COMPENSATING FOR LINE VOLTAGE VARIATIONS

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Original application May 14, 1954, Ser. No. 429,731, now Patent No. 2,914,722, dated Nov. 24, 1959. Divided and this application May 1, 1959, Ser. No. 810,463

3 Claims. (Cl. 323—2)

This invention relates to systems for compensating for variations in line voltage and other factors in an alternating current supply system and particularly to an arrangement for controlling a resonant circuit or static regulator in the system. This application is a division of copending application Serial No. 429,731, filed May 14, 1954, U.S. Pat. No. 2,914,722, which is a continuation-in-part of application Serial No. 339,141, filed February 26, 1953, now abandoned.

It is desirable in certain load circuits, such as lighting circuits, to provide arrangements to keep the current constant therein. The regulation of lamp current within a relatively narrow range is important in order to obtain reasonable lamp life and steady illumination. In resonant constant voltage to constant current transformation circuit means, such as the arrangement known as a monocyclic square, if the potential supplied thereto is constant, the current will be substantially constant, but if the potential varies, there will be a variation in load current.

One of the objects of the invention is to provide a circuit arrangement for a resonant circuit or static regulator system in which constant current will be supplied to the load regardless of variations, within limits, of line voltage and other factors.

Another object of the invention is to provide a circuit arrangement for a static type regulator of the resonant constant voltage to constant current type, wherein changes in the load current are utilized to apply corrections to saturable electro-magnetic devices in the system so as to maintain a constant applied current to the load.

In one aspect of the invention, a source of alternating current is connected to a resonant costant voltage to constant current transformation circuit, the output of said circuit being connected to the load which, for example, may be a lighting load. The resonant circuit may be a monocyclic square or a T circuit as will be described hereafter. A current sensing transformer or device is connected in the load circuit for producing a signal proportional to or a function of the load current This signal is fed to a means comparing and amplifying any deviation therefrom to produce an indication signal. The means for producing the indication signal may be electromechanical, electronic, a magnetic amplifier or other similar device. The signal from the sensing and amplifying means is applied to the direct current winding of the saturable electro-magnetic means which in this application is a saturable transformer arrangement. The saturable electro-magnetic device concerned has at least a control and a gate or load winding associated with a common core.

These and other objects, features and advantages of the invention will become apparent from the following description and drawings, which are merely exemplary.

In the drawings:

FIG. 1 is a circuit arrangement employing a saturable transformer arrangement.

FIG. 2 illustrates another form of a resonant constant voltage to constant current transformation circuit which can be used in conjunction with a saturable transformer.

The arrangements involved are particularly concerned with supplying a constant load current to a load by a

resonant constant voltage to constant current transformation circuit independent of load impedance. The resonant constant voltage to constant current transformation circuit may be of the monocyclic square type wherein the input is connected to two sides of a bridge arrangement having capacitors in opposite legs of the bridge and reactors in the other legs. It is also applicable to a resonant constant voltage to constant current transformation circuit of the T type, as will be explained hereinafter. The T type has two reactors in series with a capacitor corrector across the line and between said reactors.

In these arrangements of resonant circuits, if the line voltage changes, the load current from the regulator will change proportionately, such being very objectionable. Inasmuch as it is well known that line voltage will not stay constant and may change as much as 10% either way, there will be a constant change in load current. The supply frequency and the capacitance and reactances of the resonant constant voltage to constant current transformation device also may vary so that compensation therefor must be provided for efficient operation of the arrangement.

In one form of the invention, a monocyclic square is used which is tuned by resonating the reactance of the inductors and capacitors that are in the monocyclic square. Changing one or the other sets of elements alone from resonance has been found to be an effective way to change current level over a limited range, for example, $\pm 10\%$ of the normal current. Change of $\pm 30\%$ in the reactance of the reactor from the resonance value is sufficient to compensate for a $\pm 10\%$ change in line voltage in order to maintain a constant load current.

As an example of a circuit employing a saturable transformer, reference may be made to FIG. 1. The monocyclic square G has reactors **108**, **109** in two arms thereof and capacitors **110** and **111** in the other arms thereof, said monocyclic square being supplied by a source of alternating current. The output of the monocyclic square G is connected to saturable transformer **113**, said saturable transformer having primary windings **114** and **115** connected to the opposite corners of the monocyclic square. Secondaries **116** and **117** are connected in load circuit **118** having the load diagrammatically illustrated at **119**. The D.C. control winding **120** is inductively related to the windings of the saturable transformer **113**. Current sensing transformer **121** has its primary **122** in the load circuit, the secondary **123** being connected to solenoid **124**. Solenoid **124** may operate contact fingers **125** in devices such as the type known as "Regohm," having fingers which are connected to the resistor **125'** thereof, such being an electro-mechanical comparing device. Other types of comparing devices can be used such as electronic tube or magnetic amplifiers as described in said copending application Serial No. 429,731.

Power for the control current may be supplied from the supply source **112** through a control transformer **127**. Bridge rectifier **128** supplies control D.C. to the control winding **120** in accordance with the current flowing in the load circuit **118**.

Merely by way of example, the saturable output transformer **113** can be one built on a three-legged core with the control winding on the middle leg and the alternating current winding on the outer two legs. One primary and one secondary alternating current coil can be placed on each outer leg, the two primary coils being connected in series and the two secondary coils connected in series in such a manner that there will be no induced line frequency voltage in the control windings.

In the embodiment shown in FIG. 2, input power can be supplied to terminals **90** by an input transformer to the

T type resonant constant voltage to constant current transformation circuit D. This circuit comprises reactors **91** and **92** in series with primary **93** of the output transformer **94**. A capacitor **95** is connected at one point between reactors **91** and **92** and at its other side between primary **93** and terminal **90**. A saturable transformer **94** is illustrated having a D.C. control winding **96**.

The secondary **97** of the output transformer **94** can be connected to the load circuit at points E, E. A current sensing transformer in the load circuit then can be used to supply control voltage at C, C to the D.C. control winding **96** at C', C' of FIG. 2.

It should be apparent that variations may be made in the details of construction and arrangement without departing from the spirit of the invention except as defined in the appended claims.

What is claimed is:

1. In a system for compensating for variations in an alternating current supply system with respect to a power distribution load circuit, the combination including a resonant constant voltage to constant current transformation circuit means for feeding said load circuit, signal means directly connected to said load circuit producig a signal proportional to the load current in said load circuit, means comparing and amplifying deviation of said signal from a predetermined value to produce an indication signal, a saturable transformer means connecting said resonant circuit with said load circuit, said saturable transformer means having control winding means, and means connecting the control winding means of said saturable transformer means with said indication signal.

2. In a system for compensating for variations in an alternating current supply system with respect to a power distribution load circuit, the combination including a resonant constant voltage to constant current transformation circuit means feeding a load circuit, said resonant

circuit having a pair of reactors connected in series with the input and output and a capacitor across the input and between said reactor, a saturable transformer connected to said resonant circuit and having control winding means, signal means directly connected to said load circuit producing a signal proportional to the load current in said load circuit, means comparing and amplifying deviation of said signal from a predetermined value to produce an indication signal, and means connecting the output of said means comparing and amplifying said signal to said control winding meas to maintain constant load current in the load circuit.

3. In a system for compensating for variations in an alternating current supply system with respect to a power distribution load circuit, the combination including a resonant constant voltage to constant current transformation circuit means feeding a load circuit, said resonant circuit including a monocyclic square having four interconnected arms with capacitors in two opposite arms and reactors in the other two opposite arms, a saturable transformer connected to said resonant circuit and having control winding means, signal means directly connected to said load circuit producig a signal proportional to the load current in said load circuit, means comparing and amplifying deviation of said signal from a predetermined value to produce an indication signal, and means connecting the output of said means comparing and amplifying said signal to said control winding means to maintain constant load current in the load circuit.

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