Oct. 9, 1945. E. H. HAUG 2,386,458

CONSTANT CURRENT REGULATOR

Filed Jan. 5, 1944

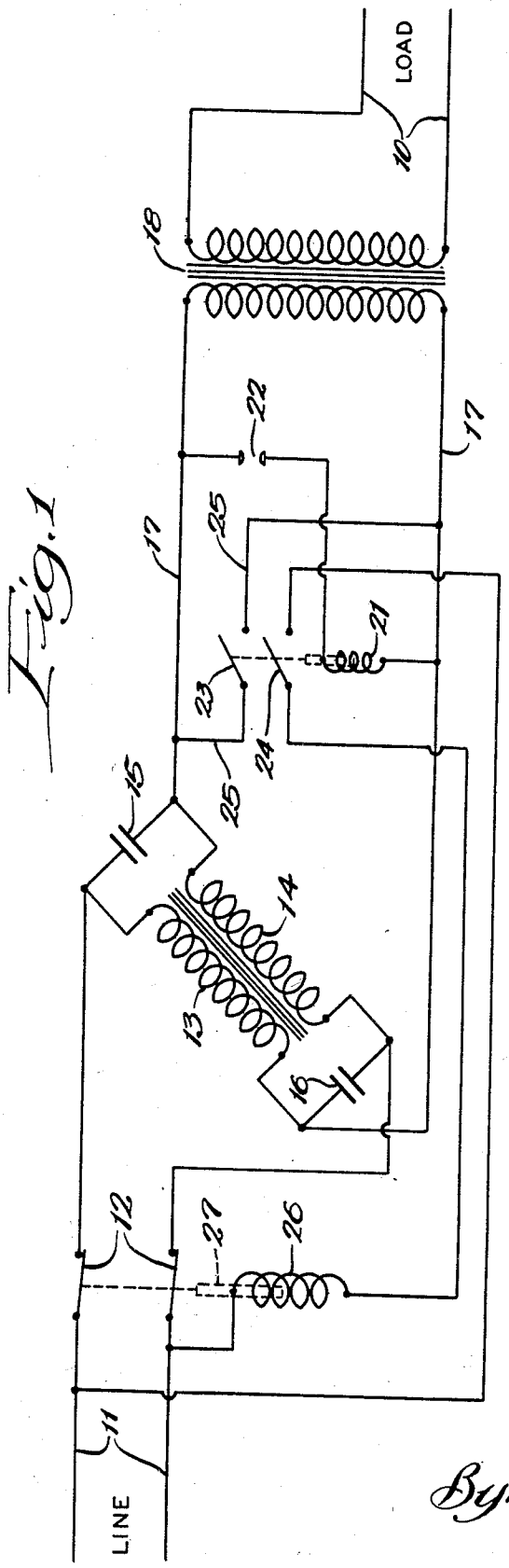


Fig. 1

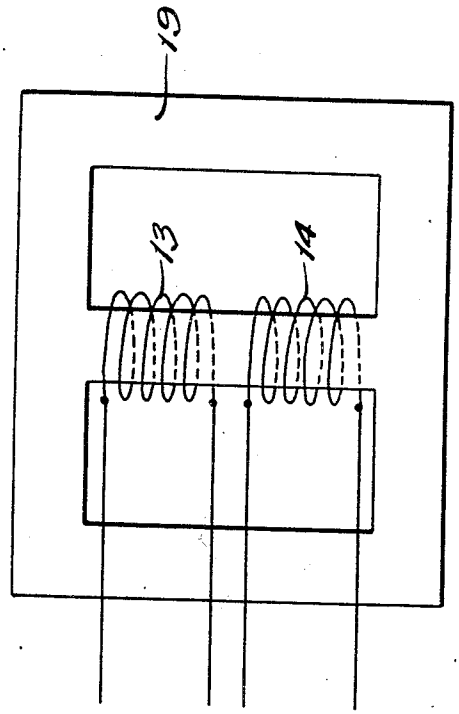


Fig. 2

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Patented Oct. 9, 1945

2,386,458

UNITED STATES PATENT OFFICE

2,386,458

CONSTANT CURRENT REGULATOR

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Application January 5, 1944, Serial No. 517,066

2 Claims. (Cl. 171—119)

This invention relates to constant current regulator and more particularly to a construction employing a resonant circuit to convert constant voltage to constant current.

One of the objects of the invention is to provide a constant current regulator in which fluctuations of the supply voltage do not produce corresponding fluctuations in the output current.

Another object of the invention is to provide a constant current regulator which has a relatively high time constant so that the output current will not follow changes of short duration in the supply voltage.

Still another object of the invention is to provide a constant current regulator in which increases in the supply voltage cause increased leading current to be introduced into the supply circuit.

A further object of the invention is to provide a constant current regulator in which shorting of the load circuit does not produce surges in the regulator or the supply circuit.

The above and other objects and advantages of the invention will be more readily apparent from the following description when read in connection with the accompanying drawing, in which:

Figure 1 is a circuit diagram of a regulator embodying the invention; and

Figure 2 is a view illustrating the reactance windings of the resonant circuit.

The construction shown in Figure 1 is adapted to supply constant current to a load circuit 10 from an alternating current supply circuit 11. As shown, the supply circuit is connected through switch blades 12 to the opposite corners of a bridge circuit including a pair of reactors 13 and 14 and a pair of condensers 15 and 16. The remaining corners of the bridge circuit are connected through wires 17 to the primary of a transformer 18 whose secondary is connected to the load circuit.

According to the present invention, the bridge circuit is so constructed that it is not resonant at the operating frequency. To this end the reactors 13 and 14 are designed to have a substantially greater impedance than the condensers 15 and 16. I have found that satisfactory performance can be obtained when the impedance of the reactors is at least 20% in excess of the condensers. Greater values for the reactors are also satisfactory and are preferable in some cases since increase of the reactance increases the time constants of the circuit.

The reactance windings 13 and 14 are preferably wound on a common core 19 as shown in Figure 2. With this construction, each winding requires only half as many turns as where separate cores are employed. The windings further provide inductive coupling between the two sides of the resonant circuit. In addition with this construction the inductance varies with the fourth power or greater of the impressed voltage so that the impedance increases upon an increase in voltage in the supply circuit at a very rapid rate.

With the resonant circuit designed as explained above, I have found that the current supplied to the load circuit does not vary in proportion to changes in the supply voltage. While an increase in supply voltage will be reflected in some increase in the load current, the current increase will be substantially less than that of the supply voltage. This is believed to be due to the fact that at increased voltage a greater leakage of current through the condenser paths of the resonant circuit occurs. Another advantage of this is that greater flow of current through the condenser paths increases the leading current introduced into the supply circuit by the resonant circuit to improve its power factor.

Since the resonant circuit has a relatively high time constant which may be as much as several minutes it serves to damp voltage fluctuations of short duration which are not affected at all in the load circuit. Further, on any sudden change in circuit conditions such as suddenly shorting or opening the load circuit surges which might damage the resonant circuit or which might adversely affect the supply circuit are prevented.

The regulator may therefore be readily controlled by shorting the supply circuit and for this purpose a solenoid 21 is connected to one of the wires 17 and through a gap 22 to the opposite wire 17. The solenoid controls two switch blades 23 and 24 which may, if desired, be so arranged that blade 23 will close slightly ahead of blade 24. Blade 23 is connected by wires 25 directly across the wires 17 to short the load circuit when the solenoid 21 is energized. The blade 24 is connected in circuit with a solenoid 26 which is supplied from the supply circuit 11. The solenoid 26 operates a core 27 which is connected to the switch blades 12 to open them when the solenoid is energized.

In the event of a break in the load circuit the voltage across the wires 17 will bend up until the gap 22 discharges. At this time the switch blade 23 will be closed to short the load circuit so that a minimum current will be supplied through the

switch 12 to the resonant circuit. Closing of the switch 24 energizes the solenoid 26 to open the switch 12 so that this switch is always opened with a minimum current flowing therethrough. If desired, manual means may be provided in addition to the solenoid 21 to operate the switch blades 23 and 24 at will.

While one embodiment of the invention has been shown and described in detail herein, it will be understood that this is illustrative only and is not intended as a definition of the scope of the invention, reference being had for this purpose to the appended claims.

What is claimed is:

1. In combination with an alternating current supply, a constant current regulator comprising a pair of reactors and a pair of condensers connected in a bridge circuit, connections from the supply to opposite corners of the bridge circuit, connections from the remaining corners of the bridge circuit to a load, the impedance of the reactors being substantially in excess of that of the condensers at the operating frequency.

2. In combination with an alternating current supply, a constant current regulator comprising a pair of reactors and a pair of condensers connected in a bridge circuit, connections from the supply to opposite corners of the bridge circuit, connections from the remaining corners of the bridge circuit to a load, the reactors being wound on a common core and each having a number of turns such as to provide an impedance substantially in excess of that of the condensers at the operating frequency.

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