

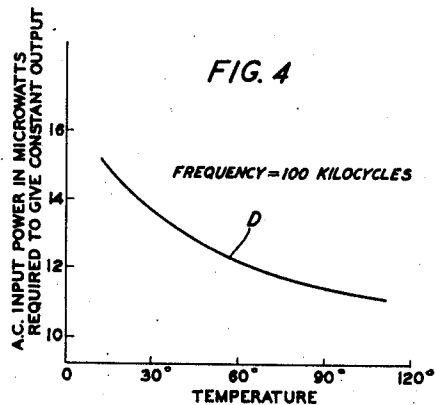
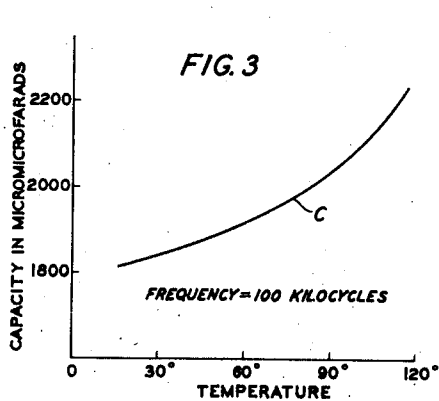
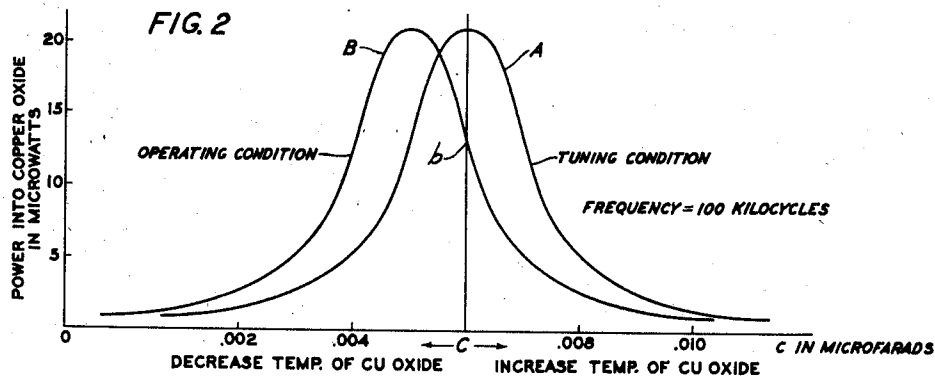
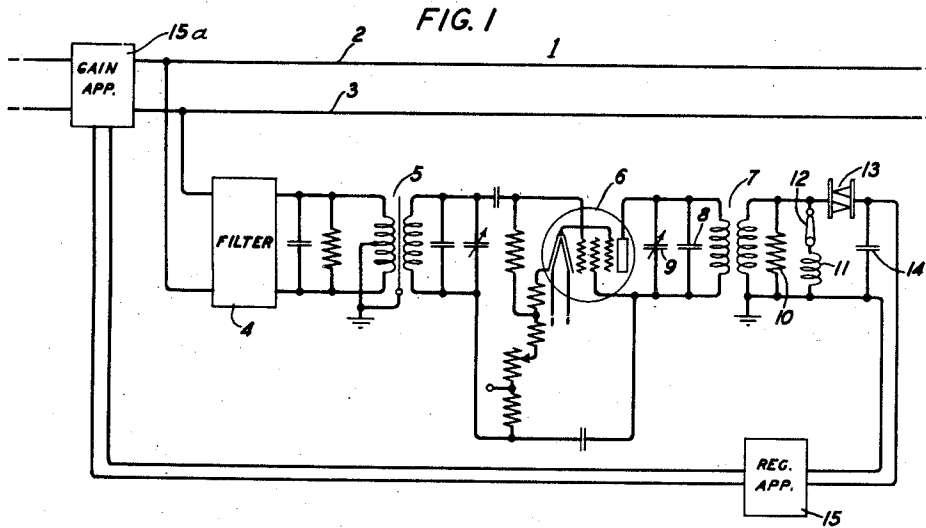
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RECTIFIER CIRCUIT

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RECTIFIER CIRCUIT

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9 Claims. (Cl. 250—30)

This invention relates to rectifier circuits and particularly to rectifier circuits employing rectifiers having variable rectification efficiency with temperature changes.

5 One object of the invention is to provide a circuit having a constant frequency current impressed thereon and comprising a rectifier having rectification efficiency variations with temperature changes that shall be controlled according to temperature changes by the rectifier to compensate for the rectification efficiency changes of the rectifier with temperature changes.

10 Another object of the invention is to provide a circuit having a constant frequency current impressed thereon and including a copper oxide rectifier having capacity reactance changes and rectification efficiency changes with temperature changes that shall be off tuned so that the capacity changes of the rectifier with temperature changes vary the operating position on the tuning curve of the circuit to compensate for the rectification efficiency changes of the rectifier with temperature changes.

15 A further object of the invention is to provide a circuit having a constant frequency current impressed thereon and comprising capacity and inductive reactances and a copper oxide rectifier that shall be tuned by capacity variation to supply maximum alternating power to the rectifier and eliminate inductance to off tune the circuit so that changes in capacity by the rectifier with temperature change vary the operating position on the tuning curve to compensate for the rectifier efficiency changes with temperature changes.

20 When copper oxide rectifiers are subjected to temperature changes, variations are caused in the efficiency or ratio of output to input of the rectifiers. The changes in the efficiency of copper oxide rectifiers with temperature changes impair the accuracy of many types of circuits employing such rectifiers. Thus measuring circuits or control circuits of the marginal type are rendered less accurate if copper oxide rectifiers subjected to temperature changes are included in them.

25 According to the present invention a circuit employing a copper oxide rectifier is controlled in a manner to compensate the rectifier for the rectification efficiency changes caused by temperature changes. The capacity of a copper oxide rectifier varies with temperature changes very similar to the efficiency changes of the rectifier with temperature changes. The changes in the capacity of the copper oxide rectifier are employed to control the alternating power input to

the rectifier so as to compensate for the efficiency changes of the rectifier caused by temperature changes.

In the arrangement employed to describe the invention, a transmission line having carrier channels and a pilot channel thereon has a gain control circuit connected thereto by means of a filter. The filter selects the pilot current on the transmission line for control purposes. The input circuit of a pilot frequency amplifier is connected to the output circuit of the filter. The output circuit of the amplifier is connected to a control circuit containing capacity and inductive reactances and a rectifier of the copper oxide type. The copper oxide rectifier is connected in series circuit relation and a condenser is connected across the output of the circuit for smoothing out the rectified impulses. A copper oxide rectifier when subjected to temperature changes varies the power output therefrom, an increase in temperature increasing the power output. Furthermore, the capacitive reactance of a copper oxide rectifier varies with temperature changes. The control circuit connected to the pilot current amplifier and including the copper oxide rectifier is so governed as to compensate the rectifier operation for any changes that may take place by reason of temperature changes.

30 The capacity in the control circuit is adjusted so that the circuit is tuned to supply maximum alternating current to the copper oxide rectifier. After tuning the control circuit to supply maximum alternating power to the rectifier, parallel inductive reactance is eliminated from the circuit to insure that the circuit is off tuned and less than maximum alternating power is supplied to the rectifier. The circuit may also be off tuned by adding series inductive reactance or by controlling the capacity reactance. In a circuit so constructed and including a copper oxide rectifier the changes in capacity of the rectifier for temperature changes varies the operative position of the control circuit on the tuning curve to compensate for the changes in output power from the rectifier caused by temperature changes.

35 If the temperature to which the copper oxide rectifier is submitted increases, the efficiency of the rectifier increases and the capacity of the rectifier increases. The increase in the capacity of the rectifier lowers the operating position on the slope of the tuning curve of the control circuit to reduce the alternating current power impressed upon the rectifier. The reduction in the alternating power impressed on the rectifier com-

pensates for the change in the rectifier efficiency caused by temperature changes. Opposite action takes place in case the temperature of the copper oxide rectifier is reduced.

5 The rectified pilot current supplied by the copper oxide rectifier is employed for controlling apparatus to govern the gain on the transmission line. Circuits of this general type are disclosed in the patent to J. W. Beyer et al., No. 2,066,514,
10 issued January 5, 1937.

In the accompanying drawing, Fig. 1 is a diagrammatic view of a circuit constructed in accordance with the invention;

15 Fig. 2 shows tuning curves for the circuit shown in Fig. 1;

Fig. 3 is a curve showing the change in capacity of a copper oxide rectifier with temperature changes;

20 Fig. 4 is a curve showing the alternating current input voltage or power required to give constant output from a copper oxide rectifier with temperature changes.

Referring to Fig. 1 of the drawing, a transmission line 1 comprising conductors 2 and 3 is provided with carrier channels and a pilot frequency channel. A filter 4 is connected to the conductors 2 and 3 for selecting the pilot frequency current on the transmission line 1. The filter 4 is connected by transformer 5 to the input circuit of a pilot frequency amplifier tube 6. The secondary winding of the transformer 5 is tuned to the pilot frequency in order to obtain a high voltage set-up. The output from the amplifier 6 is supplied to a control circuit which serves to supply rectified current which varies in value directly according to the strength of the pilot frequency current on the transmission line. The control circuit including the output from the amplifier 6 comprises a transformer 7 with a fixed capacity 8 and an adjustable capacity 9
40 connected across the primary winding of the transformer. A resistance element 10 and an inductive element 11 are connected across the secondary winding of the transformer 7. A switch 12 is provided for eliminating the inductive element 11 during operating conditions. A copper oxide rectifier 13 is connected in series with the secondary winding of the transformer 7. A smoothing condenser 14 is connected across
50 the control circuit. Regulating apparatus 15 connected across the condenser 14 is provided for controlling apparatus 15a to govern the gain on the transmission line 1. The regulating apparatus 15 and the apparatus 15a may be of the type disclosed in the patent to J. W. Beyer et al., No. 2,066,514, issued January 5, 1937.

The regulating apparatus 15 is governed according to the rectified voltage supplied by the copper oxide rectifier 13. The copper oxide rectifier 13 may be subjected to considerable temperature changes and temperature changes vary the efficiency of a copper oxide rectifier. In order to compensate for the variations in efficiency of the rectifier with temperature changes the capacity changes of the copper oxide rectifier with temperature changes are employed to control the circuit including the copper oxide rectifier, so as to compensate for the variations in the efficiency with temperature changes. The circuit
70 including the output circuit of the amplifier 6, the condenser 14 and the copper oxide rectifier 13 is tuned by varying the adjustable capacity 9 so that maximum alternating power is supplied to the rectifier 13.

75 Referring to the curves shown in Fig. 2, which

are drawn with capacity for abscissa and alternating current power into the copper oxide rectifier for ordinates, the curve A may be considered the tuning curve for the circuit including the copper oxide rectifier 13. When the control circuit
5 is tuned, as shown by the curve A, then maximum alternating current power is impressed on the copper oxide rectifier 13. In order to effect operation of the control circuit on a slope of the tuning curve, the inductance 11 is withdrawn from
10 the circuit by opening the switch 12. The circuit is then off tuned, as shown by the curve B, and the operating point may be considered on the slope of the tuning curve at point b. When the operating point for the circuit is on the slope of
15 the tuning curve it is apparent that any change in the tuning of the circuit will move the operating point along the slope so as to change the alternating power impressed on the copper oxide
20 rectifier.

Referring to Fig. 3 of the drawing, a curve C is drawn with degrees Fahrenheit temperature for abscissa and capacity for ordinates. This curve illustrates the change in the capacity of a copper oxide rectifier which takes place with variations in temperatures. It will be noted that the capacity of the copper oxide rectifier rises as the temperature increases.

Referring to Fig. 4 of the drawing, a curve D is drawn with degrees Fahrenheit temperature for
30 abscissa and alternating current input power to the rectifier required to give constant output for ordinates. The curve D shows that if constant power output is required for the copper oxide rectifier and the temperature changes, some correction must be made to the alternating power
35 impressed on the rectifier. If the temperature of the rectifier is raised then the alternating power impressed upon the rectifier must be reduced.

The change in the capacity of the copper oxide rectifier varies the operating position on the tuning curve B to compensate the changes in efficiency of the copper oxide rectifier which are caused by changes in temperature. If the temperature of the copper oxide rectifier is raised, the operating point b on the tuning curve B,
45 Fig. 2, is lower on the slope of the tuning curve so that there is a decrease in the alternating power impressed on the copper oxide rectifier. This
50 compensates for the increase in rectification efficiency of the rectifier caused by the increase in temperature. An opposite effect takes place in case the temperature of the rectifier is reduced. In the above manner, compensation is made for
55 the changes in the output from the rectifier that may be caused by temperature variations.

Modifications in the circuit and in the arrangement and location of parts may be within the spirit and scope of the invention and such modifications are intended to be covered by the appended claims.

What is claimed is:

1. In combination, a circuit having elements with inductive and capacity reactance therein and having a fixed frequency current impressed thereon, a rectifier connected in said circuit in series circuit relation at the output end thereof, the rectification efficiency of said rectifier and the capacity thereof varying with temperature changes, and means for off tuning said circuit so that less than maximum alternating power is supplied to said rectifier and so that changes in capacity by said rectifier caused by changes in temperature vary the operating position of said
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circuit on the tuning curve to compensate for changes in the rectifier efficiency caused by temperature changes.

2. In combination, a circuit having elements with inductive and capacity reactance therein, and having a fixed frequency current impressed thereon, a rectifier connected in said circuit in series circuit relation at the output end thereof, the efficiency of said rectifier and the capacity thereof varying with temperature changes, means comprising an adjustable capacity element in said circuit for tuning said circuit to supply maximum alternating power to said rectifier and means for eliminating inductance from said circuit after tuning thereof to effect operation of said circuit on a slope of the tuning curve so that changes in capacity by said rectifier caused by temperature changes vary the operating position on the tuning curve to compensate for changes in the rectifier efficiency caused by temperature changes.

3. In combination, a circuit having elements with inductive and capacity reactance therein and having a fixed frequency current impressed thereon, a copper oxide rectifier connected in said circuit in series circuit relation at the output end thereof, the rectification efficiency of said rectifier and the capacity thereof varying with temperature changes, and means for off tuning said circuit so that less than maximum alternating power is supplied to said rectifier and so that changes in capacity by said rectifier caused by changes in temperature vary the operating position of said circuit on the tuning curve to compensate for changes in the rectifier efficiency caused by temperature changes.

4. In combination, a circuit having elements with inductive and capacity reactance thereon and having a fixed frequency current impressed thereon, a copper oxide rectifier connected in said circuit in series circuit relation at the output end thereof, the efficiency of said rectifier and the capacity thereof varying with temperature changes, means comprising an adjustable capacity element in said circuit for tuning said circuit to supply maximum alternating power to said rectifier and means for eliminating inductance from said circuit after tuning thereof to effect operation of said circuit on a slope of the tuning curve so that changes in capacity by said rectifier caused by temperature changes vary the operating position on the tuning curve to compensate for changes in the rectifier efficiency caused by temperature changes.

5. In combination, an amplifier supplied with pilot current having a fixed frequency, a circuit having one end thereof connected to the amplifier output, elements in said circuit having capacity and inductive reactances, a copper oxide rectifier connected in said circuit in series circuit relation at the end thereof opposite to said amplifier, the efficiency of said rectifier and the capacity thereof varying with temperature changes, means comprising an adjustable capacity element for tuning said circuit to supply maximum alternating power to said rectifier and means for eliminating inductance from said circuit after tuning thereof to effect operation of said circuit on a slope of the tuning curve so that changes in capacity by

said rectifier caused by temperature changes vary the operating position on the tuning curve to compensate for changes in the rectifier efficiency caused by temperature changes.

6. In combination, a circuit having elements with inductive and capacity reactance and having a fixed frequency current impressed thereon, a copper oxide rectifier connected in said circuit in series circuit relation at the output end thereof, the efficiency of said rectifier and the capacity thereof varying with temperature changes, means for varying the reactance in said circuit to tune said circuit to supply maximum alternating power to said rectifier, and means for changing reactance in the proper sense in said circuit after tuning thereof to effect operation of said circuit on a slope of the tuning curve so that changes in capacity by said rectifier caused by temperature changes vary the operating position on the tuning curve to compensate for changes in the rectifier efficiency caused by temperature changes.

7. In combination, an amplifier supplied with pilot current having a fixed frequency, a circuit comprising adjustable capacity, a transformer, an inductance element and a series arranged copper oxide rectifier, the efficiency of said rectifier and the capacity thereof varying with temperature changes, means for adjusting said capacity to tune the circuit before said rectifier to the frequency of said pilot current, and means for increasing the inductance in said circuit to off tune the circuit so that changes of the operating position on the tuning curve for the circuit affected by capacity changes of the rectifier with temperature change compensate for the changes in the rectifier efficiency caused by temperature changes.

8. The method of compensating for the efficiency changes of a copper oxide rectifier with temperature changes in a circuit having inductive and capacity reactance and supplied with an alternating current of fixed frequency which consists in adjusting one type of reactance in the circuit to tune the circuit for supplying maximum alternating power to the rectifier and in adjusting the other type of reactance in the circuit to effect operation of the circuit on the slope of the tuning curve so that changes in capacity by the rectifier with temperature changes vary the operating position on the tuning curve to compensate for efficiency changes of the rectifier with temperature changes.

9. The method of compensating for the efficiency changes of a copper oxide rectifier with temperature changes in a circuit having inductive and capacity reactance and supplied with an alternating current of fixed frequency which consists in adjusting the capacity reactance of the circuit to tune the circuit for supplying maximum alternating power to the rectifier and in changing the inductive reactance to effect operation of the circuit on the slope of the tuning curve so that changes in capacity by the rectifier with temperature changes vary the operating position on the tuning curve to compensate for efficiency changes of the rectifier with temperature changes.

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