April 5, 1932. P. H. DOWLING 1,852,704

ELECTRICAL APPARATUS

Filed April 1, 1931

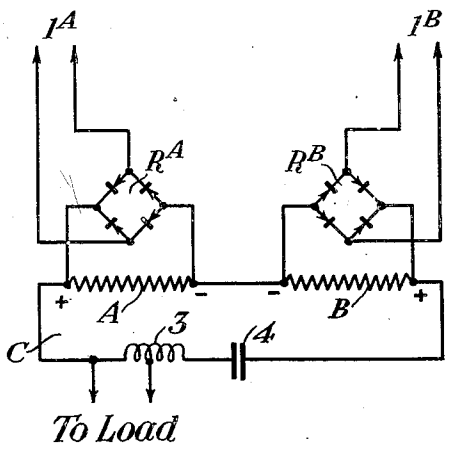

Fig. 1.

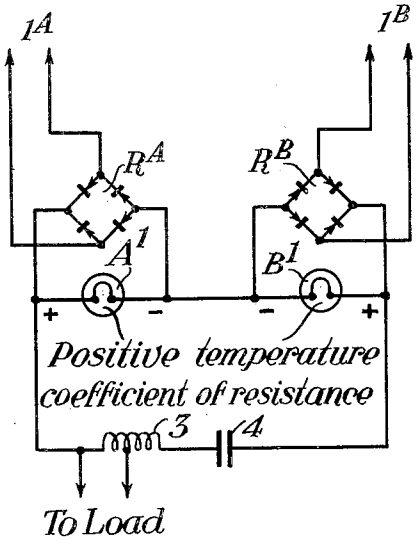

Fig. 2.

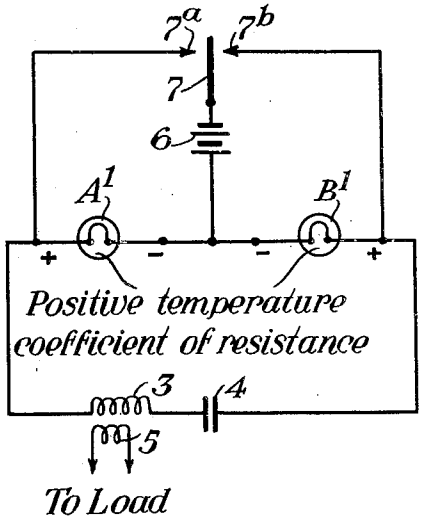

Fig. 3.

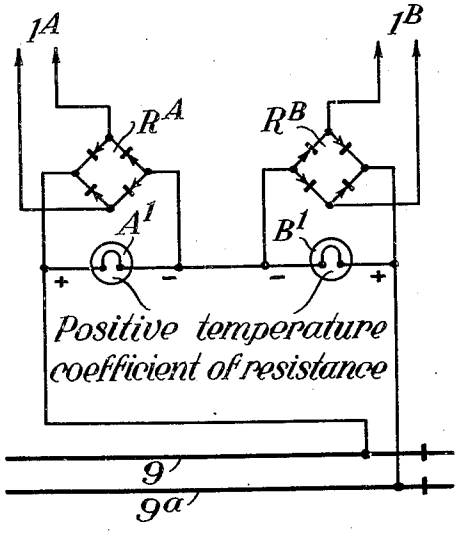

Fig. 4.

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Patented Apr. 5, 1932 1,852,704

UNITED STATES PATENT OFFICE

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ELECTRICAL APPARATUS

Application filed April 1, 1931. Serial No. 526,797.

My invention relates to electrical apparatus, and has for an object the provision of novel and improved means for alternately applying differences of potential of opposite polarities to a circuit in order to create an alternating current therein.

I will describe several forms of apparatus embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawings, Fig. 1 is a diagrammatic view showing one form of apparatus embodying my invention. Figs. 2, 3 and 4 are diagrammatic views showing modified forms of apparatus embodying my invention.

Similar reference characters refer to similar parts in each of the views.

Referring first to Fig. 1, the reference characters R^A and R^B designate two rectifiers having input circuits 1^A and 1^B, respectively. The output circuit of rectifier R^A is connected across the terminals of an impedance A, and the output circuit of rectifier R^B is connected across the terminals of an impedance B. As here shown, the impedances A and B are non-inductive resistance. The input circuits 1^A and 1^B are alternately supplied with current, and the rectifiers are so connected that the difference of potential applied to the resistance A is opposite to the difference of potential applied to resistance B. The resistances A and B are connected in a circuit C which includes a reactor 3 and a condenser 4, and so it follows that alternating current is created in this circuit by the differences of potential alternately applied to the resistances A and B. The circuit is preferably tuned by the reactor 3 and the condenser 4 to resonance at the frequency of the alternating current thus created in the circuit. A load of any suitable type may be connected across any appropriate part of the circuit, such for example, as across a portion of the reactor 3.

The input circuits for rectifiers R^A and R^B may be supplied with current from amplifiers in the manner illustrated and described in an application for Letters Patent of the United States filed by A. J. Sorensen and P. H. Dowling, on June 23, 1930, Serial No. 462,994.

It will be obvious that there are two mutually exclusive conditions which make the apparatus of Fig. 1 efficient. In order not to lose too much power in the resistance shunting the rectifier whose output is high, the values of the resistances A and B should be high; in order not to present too much series resistance in the tuned circuit C, however, the values of these resistances should be low. When the apparatus is so operated that the percentage change in the current through each resistance is large, the efficiency of the apparatus may be improved by using the resistance having relatively large temperature co-efficients of resistance.

Referring to Fig 2, the apparatus is the same as that shown in Fig. 1, except that resistances A^1 and B^1, each having a relatively large positive temperature co-efficient of resistance, have been substituted for the resistances A and B. These elements A^1 and B may, for example, be tungsten incandescent lamps. When the output of rectifier R^A becomes high, lamp A^1 will become lighted, so that its resistance will increase, with the result that it will absorb less energy for the voltage impressed across it than if its resistance had remained constant. At the same time, the output from rectifier R^B is low, so that lamp B^1 is extinguished, with the result that this lamp presents a relatively small series resistance to the current in the tuned circuit C. The impedances of the lamps and of the other elements of the circuit should be so chosen that the hot lamp has a smaller impedance than the total impedance of the circuit plus that of the other lamp. The gain in the power efficiency (power delivered to the tuned circuit divided by the total power supplied to the lamps and tuned circuit), may, with the apparatus shown in Fig. 2, be of the order of two.

Referring now to Fig. 3, the apparatus shown in this view is the same as that shown in Fig. 2, except for the means for applying differences of potential across the lamps A^1 and B^1. In Fig. 3, a battery 6 is alternately connected across these two lamps through the

medium of a movable contact member 7 which may alternately engage two fixed contact members 7^a and 7^b. The contact made up of the elements 7, 7^a and 7^b, may, for example, be the master relay which forms a part of the train-carried apparatus of what is known as the code train control or cab signaling system. In this case, the load is preferably supplied from a winding 5 in inductive relation to the reactor 3, in order to prevent false indications due to a short circuit in the condenser 4.

Referring now to Fig. 4, the apparatus shown in this view is the same as that shown in Fig. 2, except that a railway track circuit is substituted for the tuned circuit C of the preceding view. In Fig. 4, the circuit including the lamps A^1 and B^1 is connected with the two track rails 9 and 9^a of a railway track circuit, and this track circuit may, for example, be a portion of a code train control system, such as that referred to hereinbefore. When the output of rectifier R^A is high, the upper rail 9 will be positive, and the lower rail 9^a will be negative. When the output of rectifier R^B is high, the lower rail 9^a will be positive, and the upper rail 9 will be negative.

Although I have herein shown and described only a few forms of apparatus embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In combination, a circuit including two resistances each having a positive temperature co-efficient of resistance, means for alternately applying differences of potential of opposite polarities across said resistances to create an alternating current in said circuit, and means for tuning said circuit to resonance at the frequency of such alternating current.

2. In combination, a circuit including two resistances each having a positive temperature co-efficient of resistance, and means for alternately applying differences of potential of opposite polarities across said resistances to create an alternating current in said circuit.

In testimony whereof I affix my signature.

PHILIP H. DOWLING.