Oct. 25, 1949. J. G. ABBOTT 2,485,548

FREQUENCY RESPONSIVE RELAY

Filed March 28, 1946

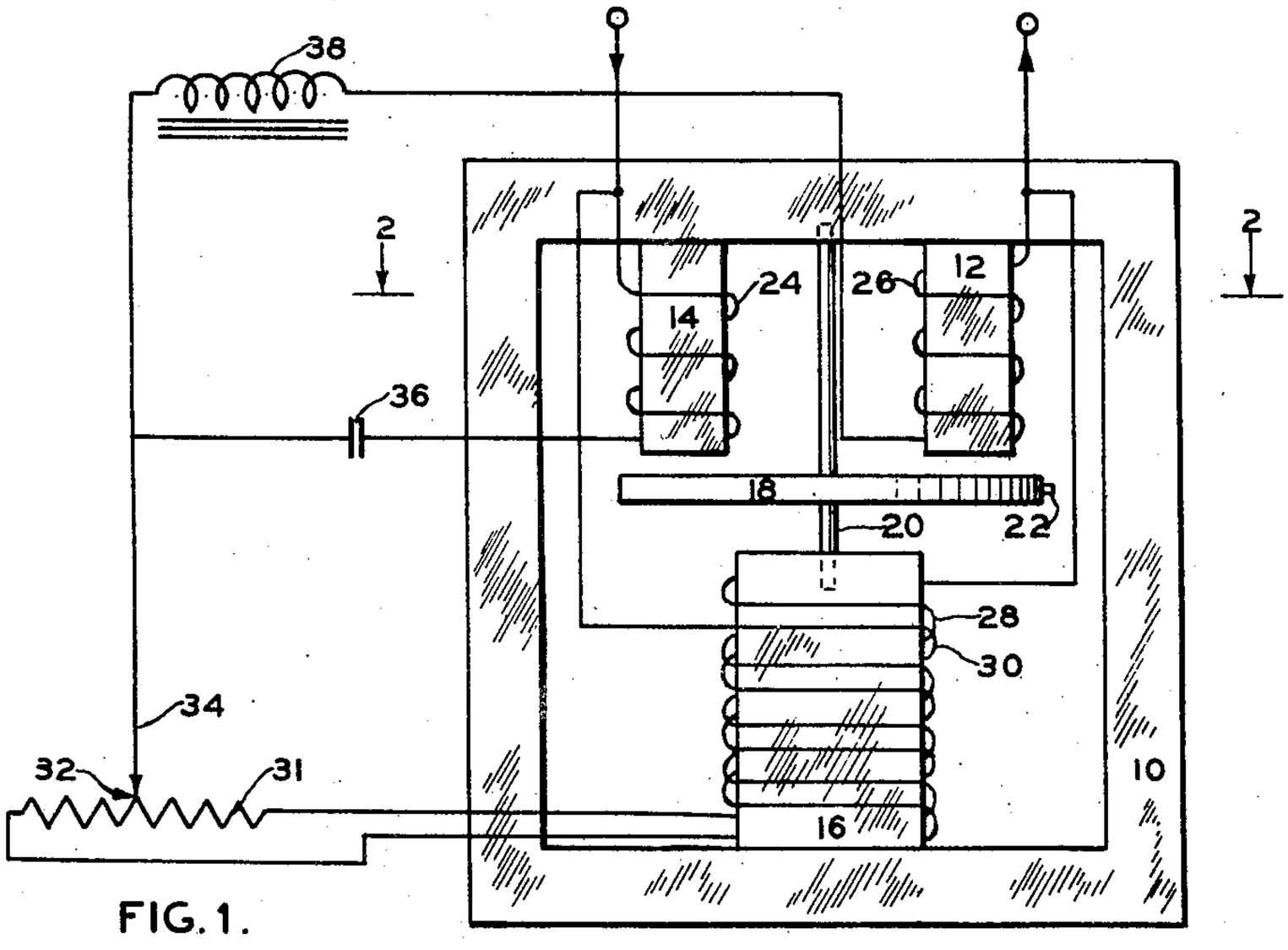

FIG. 1.

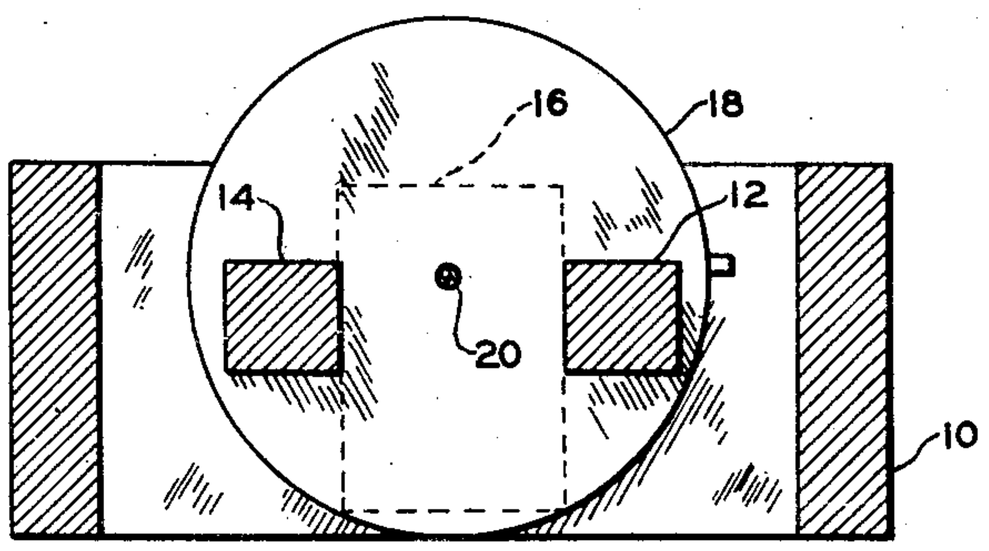

FIG. 2.

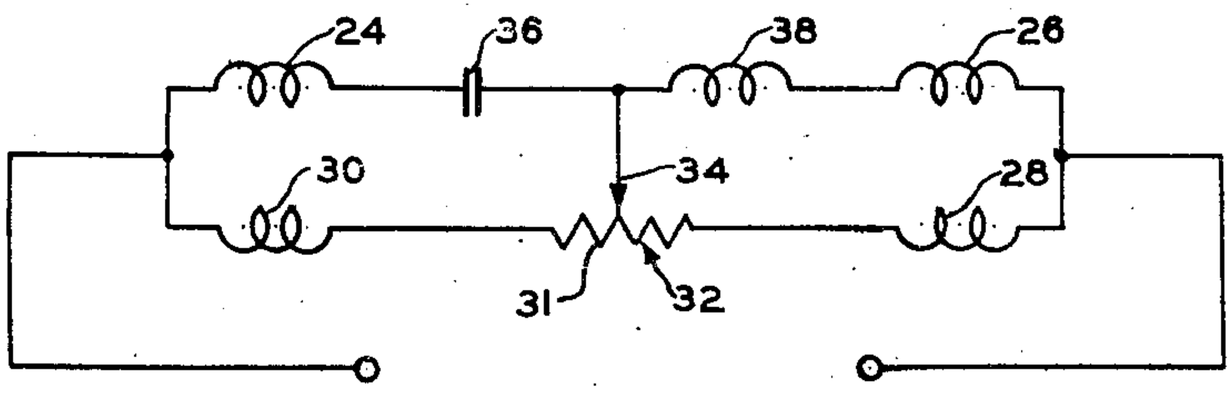

FIG. 3.

Inventor
JEROME G. ABBOTT

By William D. Hall
Attorney

Patented Oct. 25, 1949 2,485,548

UNITED STATES PATENT OFFICE

2,485,548

FREQUENCY RESPONSIVE RELAY

Jerome G. Abbott, Red Bank, N. J.

Application March 28, 1946, Serial No. 657,738

2 Claims. (Cl. 318—207)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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

The invention relates to relays and particularly to dynamic, frequency responsive relays.

It is necessary that the frequency of electrical apparatus be closely regulated. It is not convenient to check constantly the frequency of the said electrical apparatus, and it is therefore an object of the invention to provide means whereby the frequency of the said apparatus may be automatically controlled.

This object, together with other objects and advantages of the invention which will be apparent to one skilled in the art, are achieved in one embodiment of the invention by means of a system adapted to present opposite flux patterns at frequencies above and below a fixed frequency, the system including a rotative element adapted to be actuated by said opposite flux patterns.

For a better understanding of the invention, reference is made to the following specification of a system embodying the invention, the said specification to be read in connection with the accompanying drawings, in which

Figure 1 is a view, partly schematic and partly in elevation, of a system embodying the invention.

Figure 2 is a sectional view taken along line 2—2 of Figure 1.

Figure 3 is a schematic diagram of the system shown in Figure 1.

Referring to the drawings, a frame 10 formed preferably of silicon steel is provided having a pair of downwardly projecting pole pieces 12, 14 and an upwardly projecting pole piece 16. The said pole pieces 12, 14 are preferably square in cross-section and are disposed laterally with respect to the pole piece 16, which pole piece 16 is rectangular in cross-section.

A non-magnetic, inductor disc 18 is rotatably mounted between the upper pole pieces 12, 14 and the lower pole piece 16, the said disc being supported by an axle 20 having its lower end disposed in a bearing seat formed toward the rear of the upper surface of the pole piece 16 whereby the said disc is eccentrically mounted with respect to said pole pieces. An outwardly projecting contact finger 22 is formed on the periphery of the disc 18, the purpose of which will be explained below.

It will be seen that a flux path between the pole pieces 12, 14 or between the pole pieces 12, 14

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and the pole piece 16 will pass through and be concentrated in that portion of the disc 18 that is forward of the axle 20.

Identical coils 24, 26 are positioned about the pole pieces 12, 14 respectively and identical coils 28, 30 are positioned about the pole piece 16, each of said coils being wound in the same direction about their respective pole pieces. The upper ends of coils 24 and 30 are connected to one terminal of the source of electrical energy whose frequency is to be controlled and the upper ends of coils 26 and 28 are connected to the other terminal of the said source of electrical energy.

The lower ends of the coils 28 and 30 are connected together through the resistive element 31 of a potentiometer 32 and the lower ends of coils 24 and 26 are connected to a movable contactor 34 of the potentiometer 32 through a capacitor 36 and an inductor 38 respectively.

This circuit arrangement may be seen more clearly by reference to Figure 3 wherein the above described circuit is shown schematically.

As heretofore stated, the system above described is adapted to control the frequency of a source of electrical energy. It will be seen that when the system is connected across the said source of electrical energy, the potentiometer 32 may be adjusted to a setting where equal currents will flow through the coils 28 and 30 at the desired frequency. Under this condition, the magnetic field set up by the coil 28 will be cancelled by the equal and opposite magnetic field set up by the coil 30. There will exist, however, the magnetic circuit set up by the coils 24 and 26, which magnetic circuit will pass through the disc 18 and induce therein eddy currents that will be additive along a radius perpendicular to the forward faces of the pole pieces 12 and 14. The disc 18, however, will not turn since there will be no effective magnetic field set up at this time by the coils 28 and 30.

Assume, however, that the frequency of the source increases. As is well known, the impedance of a capacitor decreases with an increase in frequency and the impedance of an inductor increases with an increase in frequency. Therefore as the frequency increases, an increased current will flow through the circuit including the coil 24, the capacitor 36 and the coil 28. Similarly, a decreased current will flow through the circuit including the coil 30, the inductor 38 and the coil 26. Due to the unequal currents flowing in the coils 28 and 30, a magnetic field representing the difference between the magnetic field set up by the coil 28 and the magnetic field set up by the

coil 30 will pass through the disc 18. This resultant magnetic field will be opposed to the magnetic field set up by the eddy currents in the disc 18 generated by the coils 24 and 26 and will cause the disc to rotate in a clockwise direction. This rotation of the disc 18 will carry with it the finger 22, the finger 22 serving as a trigger to operate associated apparatus (not shown) whereby the frequency of the source of electrical energy may be restored to the desired frequency. For example, the finger 22 may serve to actuate a throttle of a gas engine driving an alternator, or the finger 22 may be used to operate a relay or any similar device, whereby the said alternator may be reduced to the desired frequency.

An opposite rotation of the disc 18 may similarly be achieved if the frequency decreases, the current through the coil 30 then increasing and the current through the coil 28 then decreasing, whereby a magnetic field in a direction opposite to that developed by the increased frequency is set up, resulting in a counter-clockwise rotation of the disc 18. If this were a situation where a gas engine were driving an alternator, counter-clockwise rotation would cause the finger 22 to increase the speed of the gas engine, thereby bringing the alternator up to the desired speed.

It will be apparent that the above described system may be used not only to control the frequency of an electrical source, but may also be used to indicate a frequency that is relatively higher or lower than a set predetermined frequency. Thus, if the disc 18 were to rotate clockwise, it would be apparent that the relay were connected to a source having a frequency higher than the set frequency. Similarly, if the disc 18 were to rotate counter-clockwise, it would be apparent that the relay were connected to a source of frequency having a frequency lower than the set frequency.

There has thus been disclosed a relay that is responsive to changes in frequency of a source of electrical energy. The relay is simple in construction and immediate in action. Many variations will occur to one skilled in the art and it is therefore intended that the invention be defined by the attached claims.

What is claimed is:

1. A relay adapted to respond when a source of electrical energy having a frequency above or below a predetermined frequency is impressed on the terminals of said relay comprising a core piece having an upwardly extending pole piece and a pair of downwardly extending pole pieces laterally disposed with respect to said upwardly extending pole piece; a pair of coils positioned about said upwardly extending pole piece; a third coil positioned about one of said downwardly extending pole pieces and a fourth coil positioned about the other of said downwardly extending pole pieces, the four said coils being wound in

the same direction about their respective pole pieces, the upper end of one coil of said pair of coils and the upper end of said third coil being connected to one terminal of said source of frequency to be controlled and the upper end of said other coil of said pair of coils and the upper end of said fourth coil being connected to the other terminal of said source, the lower ends of said pair of coils being connected together through the resistive element of a potentiometer and the lower ends of the said third and fourth coils being connected to the movable contactor of said potentiometer through a capacitor and an inductor respectively; a non-magnetic, rotatable, inductor disc eccentrically mounted between said upwardly and downwardly extending pole pieces and an outwardly extending trigger responsive to movement of said disc whereby rotation of said disc may be translated through said trigger to associated apparatus.

2. A relay adapted to respond when a source of electrical energy, having a frequency above or below a predetermined frequency, is impressed on the terminals of said relay, comprising; a core piece having an upwardly extending pole piece and a pair of downwardly extending pole pieces laterally disposed with respect to said upwardly extended pole piece; first and second coils positioned about said upwardly extending pole piece; a third coil positioned about one of said downwardly extending pole pieces; a fourth coil positioned about the other of said downwardly extending pole pieces, the four of said coils being wound in the same direction about their respective pole pieces, said first and second coils forming first and second arms of a bridge; a capacitor in series with the third of said coils forming a third arm of said bridge; an inductor in series with the fourth of said coils forming a fourth arm of said bridge, the junction of said first and fourth arms and the junction of said second and third arms connected across said source of electrical energy, the other terminals of said four arms electrically interconnected; a nonmagnetic, rotatable, inductor disc eccentrically mounted between said upwardly and downwardly extending poles, and an outwardly extending projection on said disc whereby rotation of said disc may be translated to associated apparatus.

JEROME G. ABBOTT.

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