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VAPOR RELAY CIRCUIT CONTROLLER

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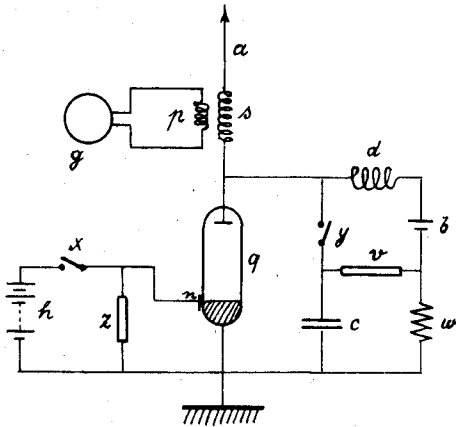


Fig. 1

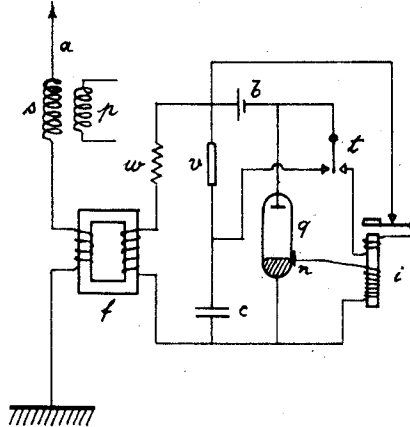


Fig. 3

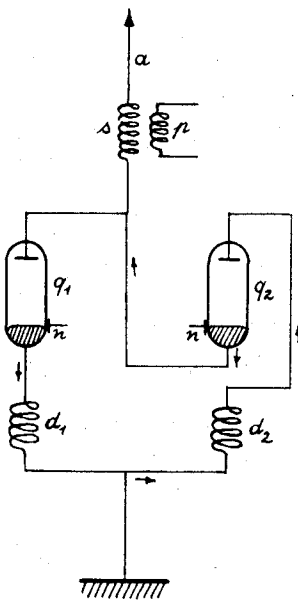


Fig. 2

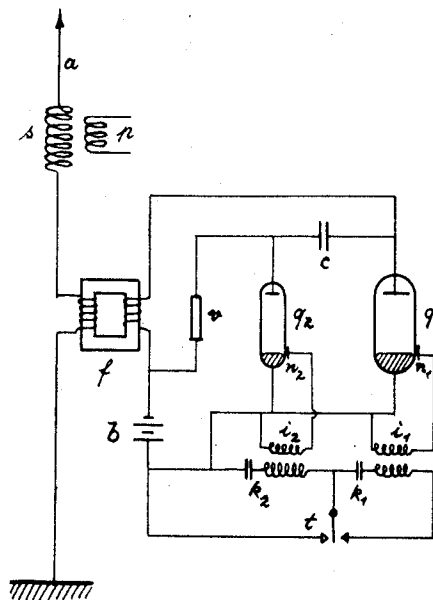


Fig. 4

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VAPOR-RELAY-CIRCUIT CONTROLLER.

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The present invention has for its object a new method for rapidly making and breaking heavy alternating currents and it is especially adopted for high speed wave telegraphy.

It has been proposed to switch continuous currents by means of a relay consisting of a mercury vapor lamp in the following way: In order to close the circuit the arc is started by means of a high tension shock imposed upon the so-called starting band of the lamp. In order to open the circuit the arc is extinguished by superposing on it an opposite shock of current, preferably by discharging a charged condenser through the arc.

This method of switching would be very advantageous for high speed wave telegraphy, because the use of inertialess relays—as realized by a mercury arc—permits of making and breaking the circuit much quicker and easier than by contact relays. However mercury arcs allow the current to pass only in one direction and can not be used directly to switch alternating currents.

According to the invention the problem of using inertialess relays for this purpose is solved by switching instead of the alternating current a continuous current connected with the first one in such a way that the existence of the continuous current is the condition for the existence or non-existence of the alternating current. This may be realized for instance in one of the following ways:

1. The alternating current may be superimposed on a continuous current furnished by an auxiliary source, and both passed through the rectifier, the sum of the two being always positive.
2. The alternating current may be rectified by means of two rectifiers or at least two anodes.
3. The alternating current may be passed through an iron core choke coil and only flows when the selfinduction of the coil has a certain value. The self inductance can then be altered by means of a continuous current flowing through the relay rectifier.
4. The alternating current may be generated by means of a frequency transformer the iron core of which is magnetized with continuous current.
5. The alternating current may be gen-

erated by a dynamo the continuous field current of which is switched by the rectifier.

The invention is illustrated by way of example in the accompanying drawings in which,

Fig. 1 is a diagrammatic arrangement conforming to the invention in which an alternating current is superimposed on a direct current and the combined current passed through a vapor rectifier.

Fig. 2 is a diagrammatic arrangement making use of two vapor rectifiers to pass the alternating current and

Figs. 3 and 4 are different modifications in which unidirectional current through a vapor rectifier serves to vary an inductance in the alternating current circuit.

The invention has been illustrated by way of example in the drawings as applied to a radio sending station and it has been found very useful for this purpose but it is quite obvious that in its more general aspects it can be used in any case where it is desired to make and break an alternating current circuit quickly by using an inertialess relay.

Referring to Fig. 1 of the drawing, *a* represents an aerial of a wireless transmitter which is energized by an alternator *g* coupled to the aerial by means of a transformer comprising the primary coil *p* and the secondary coil *s*. The antenna circuit is connected to ground through a mercury arc rectifier *q* of which the main terminals are connected to the antenna and ground, respectively, and which is provided with an auxiliary electrode *n* in the form of a starting band. A source of energy *h* of sufficiently high potential to supply the required starting pulse to the rectifier has one of its terminals connected to ground and the other to the band *n*, a switch *x* being interposed in the circuit to permit of applying the starting pulse whenever desired. A high ohmic resistance *z* is shunted across this energizing circuit between the starting band and the ground. A source of energy in the shape of a battery *b* of about fifty volts is connected across the main terminals of the rectifier *q*, a choke coil *d* and an ohmic resistance *w* being included in the circuit for purposes to be hereinafter described. A condenser *c* has one terminal connected to one terminal of the resistance *w* and its other terminal connected through a high resistance *v* to a point between the

other terminal of the resistance w and the battery b . A switch y is provided for connecting the condenser c directly across the rectifier terminals when desired.

5 The high frequency alternating current for energizing the antenna a is supplied by the generator g , all of the antenna current in this case flowing through the rectifier q owing to the choking action of the
10 choke coil d . As the rectifier will only pass current in one direction this alternating current must be superimposed on a direct current which should be at least equal in value to the maximum amplitude of the alternating current. With this arrangement
15 a unidirectional current passing through the rectifier will supply the antenna owing to its alternating current component while the direct current component will have no effect
20 on the antenna system. The direct current component of the current through the rectifier is supplied by the battery b and this current is limited by the resistance w and should be at least equal to the amplitude of the aerial current as just stated. It may in
25 certain cases, however, be somewhat smaller as the self inductance d will maintain the lamp current for short intervals. The battery b possesses sufficient power to maintain
30 a current through the rectifier q when the current is once established but has not sufficient power to establish such a current on account of the natural starting resistance of the rectifier.

35 The operation of the system is as follows:

When it is desired to start the system the switch x is closed applying the potential of the battery b to the starting band n to
40 furnish a starting pulse to the rectifier. A direct current from the battery b then flows through the rectifier through the circuit including the choke coil d and the resistance w . The switch x can then be opened and this current will continue to flow. This direct
45 current has superimposed on it an alternating voltage of the generator g and an alternating current circuit for the antenna system is established from the antenna a
50 through secondary coil s , the rectifier q to ground. The condenser c is connected across the resistance w and the direct current flowing from the battery b through the
55 resistance w serves to charge this condenser which will become charged to its capacity and remain charged as long as this current is flowing. The alternating current is interrupted by extinguishing the rectifier q
60 which may be done by closing the switch y whereupon the condenser c discharges through the lamp supplying a pulse of energy in opposition to the current flowing through the lamp of sufficient value to interrupt the flow of the continuous current
65 therethrough, it being assumed, of course,

that the condenser c is large enough to provide a discharge current of the required strength. The alternating current in the antenna circuit depends on the presence of
70 a continuous current through the rectifier q and this continuous current can be established by momentarily closing the switch x and interrupted by momentarily closing the switch y thus providing a substantially inertialess control for the alternating current. 75

Fig. 2 illustrates a system conforming to the case number 2 mentioned above in which
two rectifiers are used to rectify alternate half waves of the alternating current. In
80 this figure the alternating current circuit from the antenna a to ground is divided in two halves, one comprising the rectifier q_1 and the choke coil d_1 and the other comprising the rectifier q_2 and the choke coil d_2 . The cathode of one rectifier and the anode of
85 the other are connected to the antenna a and the opposite electrodes through their respective choke coils to ground. The branched circuit then provides a closed continuous
90 current circuit as indicated by the arrow and a path for the alternating current through the tubes is provided. The rectifiers are started and extinguished by means of the
95 starting bands n_1 and n_2 and condenser as explained in connection with Fig. 1.

The third scheme is illustrated in Fig. 3. The aerial a is in resonance with the frequency of the primary p only when the iron core choking coil f has a certain self-induction, this selfinduction being obtained
100 when a certain continuous current, furnished by the battery b , flows through the right hand windings of the coil, the resistance w and the rectifier q . The lamp is started by bringing the switch t to the right
105 hand position in order to energize the spark inductor i the secondary of which is in connection with the starting band of the rectifier. The lamp is extinguished by bringing the switch t to the left hand position, thus
110 discharging the condenser c through the rectifier.

The selfinduction of the coil f required for resonance may, in certain cases, be obtained when the continuous current is interrupted,
115 so that the aerial current flows when the rectifier is extinguished.

Another scheme of starting and extinguishing the relay rectifier q is shown in Fig. 4. The discharging of the condenser c
120 is effected in this case, by starting a second (small) mercury rectifier q_2 . When the switch t is moved alternately to the right and to the left both rectifiers are alternately
125 started by discharging the condensers k_1 and k_2 through the primary of the two small Tesla transformers i_1 and i_2 the secondary windings of which are connected with the starting bands n_1 and n_2 of the rectifiers.

The cases No. 4 and No. 5 are quite sim- 130

ilar to that of No. 3, the magnetizing windings of the frequency transformer or the field windings of the alternator replacing the right hand windings of the coil *f* of Fig. 3.

While certain specific embodiments of my invention have been particularly illustrated and described, it is to be understood that the present invention is not limited to its illustrated embodiments but may be embodied in other schemes and methods within the scope of the invention as specifically pointed out in the following claims.

I claim:

1. A device for making and breaking electric circuits comprising an element of variable conductivity, means for controlling the conductivity of said element comprising a vapor relay, a source of energy connected across said relay, means for applying a starting pulse to said relay to establish a unidirectional current therethrough, a condenser connected to said relay to be charged by the current therethrough and means for discharging said condenser through said relay to interrupt the unidirectional current.
2. A device for making and breaking an alternating current circuit comprising a vapor relay in said circuit, a source of electrical energy connected to said relay and means for establishing and interrupting a unidirectional current therethrough to selectively form or break a path for the alternating current through said relay, said last named means including means for applying a starting pulse to said relay and condenser means for applying a stopping pulse of energy to said relay by discharging through said relay.
3. A device for making and breaking an alternating current circuit comprising a vapor relay in said circuit, a source of electrical energy connected to said relay and means for establishing and interrupting a unidirectional current therethrough to selectively form or break a path for the alternating current through said relay, said last named means including means for applying a starting pulse of energy to said relay and a condenser connected to said relay to be charged by the unidirectional current therethrough and means for discharging

said condenser through said relay in opposition to the unidirectional current.

4. A control device for making and breaking an alternating current circuit comprising a vapor relay having a pair of main electrodes and an auxiliary electrode, a source of energy connected to said relay and means for applying a starting potential to said auxiliary electrode to establish a unidirectional current through said relay and a circuit connected across said main electrodes and including a source of energy to apply a pulse of energy opposed to the unidirectional current to interrupt the latter.

5. A circuit controlling device comprising a vapor relay having a pair of main electrodes and an auxiliary electrode, a source of energy connected to said relay and means for applying a starting potential to said auxiliary electrode to establish a unidirectional current through said relay and a condenser connected to said relay with means for discharging it therethrough to apply a pulse of energy in opposition to said unidirectional current to interrupt the latter.

6. A circuit controlling device comprising a vapor relay having a pair of main electrodes and an auxiliary electrode, a source of energy connected to said relay and means for applying a starting potential to said auxiliary electrode to establish a unidirectional current through said relay and a condenser connected to said relay to be charged by the current therethrough with means for discharging it in opposition to the unidirectional current to interrupt the latter.

7. A circuit controlling device comprising a vapor relay having a pair of main electrodes and an auxiliary electrode, a source of energy connected to said relay and means for applying a starting potential to said auxiliary electrode to establish a unidirectional current through said relay, a condenser connected in circuit with said source of energy and said relay to be charged by the unidirectional current and means for discharging said condenser across the terminals of said relay in opposition to the unidirectional current to interrupt the latter.

In testimony whereof I affix my signature.

WALTHER BURSTYN.