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Aug. 10, 1937.

A. B. RYPINSKI

2,089,859

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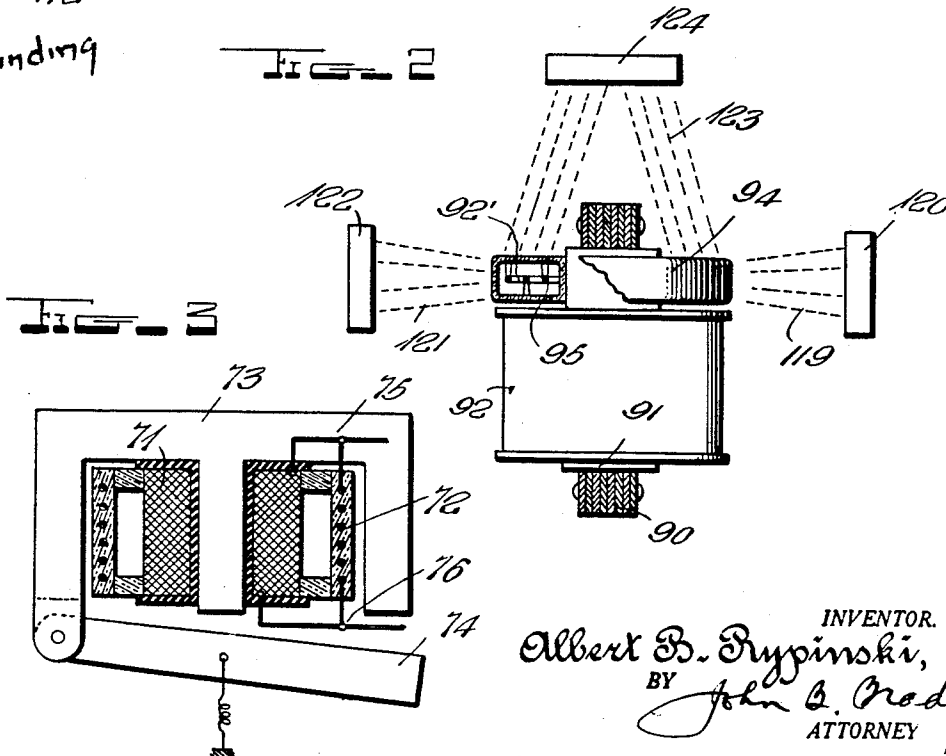
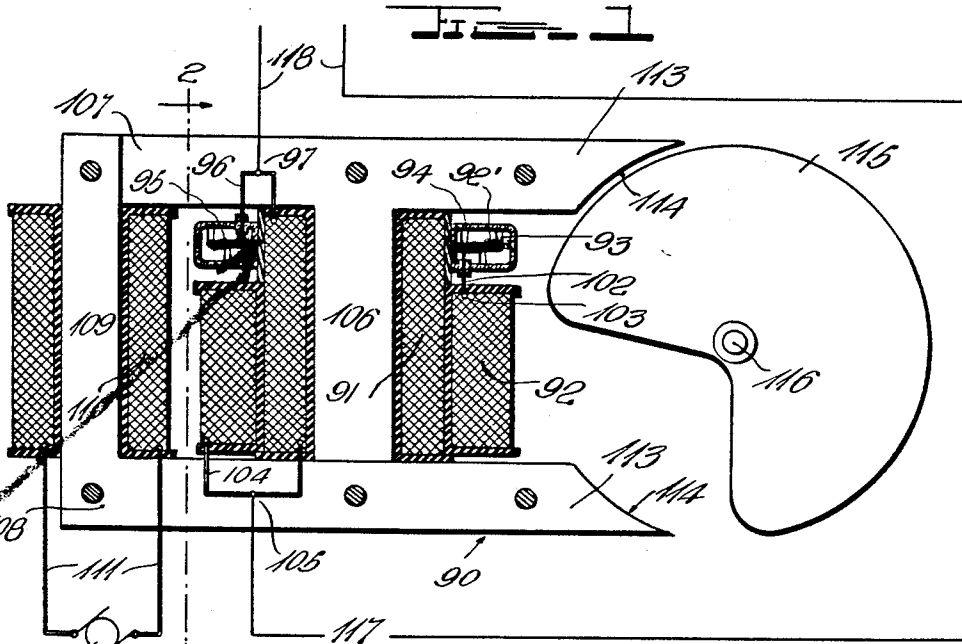
SLOW ELECTROMAGNETIC RADIATION DEVICE

Original Filed Dec. 20, 1933

2062x

2525.5

Evacuated
chamber
containing
high Temp. Winding



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SLOW ELECTROMAGNETIC RADIATION
DEVICE

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Original application December 20, 1933, Serial
No. 703,313. Divided and this application Feb-
ruary 28, 1935, Serial No. 8,727

9 Claims. (Cl. 171-119)

This application is a division of application Serial No. 703,313, patented Jan. 26, 1937, No. 2,068,712, for High temperature slow electromagnetic device, filed December 20, 1933.

5 In my co-pending application 703,313, in various co-pending applications and patents listed below I have described electromagnetic devices which produce changes in magnetism over time periods, to effect various results for numerous
10 purposes. The list is as follows:

S. N. 416,877—filed Dec. 27, 1929—for Slow magnetic regulating devices, S. N. 699,616—filed Nov. 24, 1933—for Motor starting systems, S. N. 699,617—filed Nov. 24, 1933—for Signaling systems, S. N. 699,618—filed Nov. 24, 1933—for Motor control system, S. N. 699,619—filed Nov. 24, 1933—for Distribution system, S. N. 699,620—filed Nov. 24, 1933—for Arc welding apparatus, S. N. 671,767—filed May 18, 1933—for Slow electromagnets having the same or similar temper-
15 ature coefficients of resistance materials in differential windings, S. N. 705,466—filed Jan. 5, 1934—for Slow electromagnetic devices having different temperature coefficient of resistance materials in assistant windings, Patent No. 1,884,877,
20 dated October 25, 1932, S. N. 671,768—filed May 18, 1933—for Coils for slow electromagnets and reactors, Patent No. 1,972,112, dated September 4, 1934, S. N. 608,095—filed Apr. 28, 1932—for
25 Circuit controller and Patent No. 1,972,319, dated September 4, 1934, S. N. 671,769—filed May 18, 1933—for Coils for slow electromagnets and reactors.

In general, with the exception of the Circuit
30 controller Patent 1,884,877, each of the foregoing applications employ a pair of windings inductively coupled and connected in parallel one with respect to the other. In some cases, a resistor is placed in series with one or each of the two
35 windings inside the parallel connection, the resistors supplying the temperature variable resistance element. In any case, the change in magnetism of the coil as a whole results from changes in the net resultant magneto-motive
40 force of the two paralleled and magnetically coupled windings, which changes result from variations in the relative ampere turns and amperes in the two paths. Variations in amperes result from changes in resistance with heating of the
45 parallel windings or resistors connected therewith.

My present invention is directed to additional means for effecting the purposes described in the prior applications cited and for effecting pur-
50 poses not disclosed in any prior case. In each in-

stance, the slow electromagnet device set forth herein will include the equivalent of two inductively coupled windings connected in parallel one with respect to the other. They may be formed
5 of the same or different temperature coefficient of resistance materials, but will always include in one or both windings, never in an external resistor, a part which will change in resistance with temperature. The temperature coefficients
10 may be positive or negative, the turns of the two windings equal or unequal, the windings may be connected to assist one another or to oppose one another magnetically, all as fully disclosed in the cited art.

In electromagnetic devices as commonly constructed today, the temperatures are kept at 50° C. or below. In those embodying this invention where the heating takes place in some part or all of the electromagnetic windings, the physical problems surrounding the dissipation of the extra heat produced are important. This invention is particularly directed to new means of solving heating problems and utilization of the new results obtained incidental thereto.

In the parent application Serial No. 703,313, filed December 20, 1933, I disclose a slow electromagnetic device in which the magnetism changes over a time period, and including a high temperature portion as at least part of its winding. This high temperature portion may be contained in an evacuated, gas filled or other vessel, which, incidental to its operation, passes heat rays, light rays, or electro-magnetic waves through the walls of the vessel.

The general purpose of the invention in this divisional application is to disclose and claim the utilization of this radiation of heat, light or electromagnetic waves.

One of the objects of my invention is therefore to construct a slow electromagnetic radiation device with walls capable of transmitting radiant heat, to effect the operation of a radiant heat responsive device external to the electromagnetic device.

Another object of my invention is to construct a slow electromagnetic radiation device with walls capable of transmitting light, to effect the operation of a light responsive device external to the electromagnetic device.

Still another object of my invention is to construct a slow electromagnetic radiation device with walls capable of transmitting radiant electromagnetic waves, to effect the operation of an external device responsive to electromagnetic waves.

A further object of my invention is to construct a slow electromagnetic radiation device with walls capable of transmitting radiant heat and light, to effect the operation of an external device responsive to radiant heat and light.

A still further object of my invention is to construct a slow electromagnetic radiation device with walls capable of transmitting radiant heat and electromagnetic waves, to effect the operation of an external device responsive to radiant heat and electromagnetic waves.

Another object of my invention is to construct a slow electromagnetic radiation device with walls capable of transmitting light and electromagnetic waves, to effect the operation of an external device responsive to light and electromagnetic waves.

A further object of my invention is to construct a slow electromagnetic radiation device with walls capable of transmitting radiant heat, light and electromagnetic waves, to effect the operation of an external device responsive to radiant heat, light and electromagnetic waves.

In my aforesaid related cases enumerated above I show slow electromagnetic devices used to introduce slow changing magnetism in the operation of various electrical apparatus.

The following list gives the general uses:

1. To move a core, keeper, armature or rotating part;
2. To attract or repel other electromagnets;
3. To attract or repel an electric arc;
4. To alter its own resistance, inductive reactance or power factor;
5. To alter the current, voltage or power factor of a circuit in which it is connected;
6. To produce a voltage or current in a secondary winding by electromagnetic induction;
7. To produce a hum or rattle at one stage of operation and to be silent at another.

In addition application Serial No. 703,313, of which this is a division, discloses the utilization of a high temperature slow electromagnetic device as follows:

8. To radiate heat from its high temperature winding;
9. To radiate light from its high temperature winding;
10. To radiate electromagnetic waves from its high temperature winding.

In the description and claims to follow additional uses will be brought out as follows:

11. To radiate heat effectively, to operate an external heat sensitive device;
12. To radiate light effectively, to operate an external light sensitive device;
13. To radiate electromagnetic waves effectively, to operate an external device sensitive to electromagnetic waves;
14. To simultaneously radiate heat and light effectively, to operate an external device sensitive to heat and light;
15. To simultaneously radiate heat and electromagnetic waves effectively, to operate an external device sensitive to heat and electromagnetic waves;
16. To simultaneously radiate light and electromagnetic waves effectively, to operate an external device sensitive to light and electromagnetic waves;
17. To simultaneously radiate heat, light and electromagnetic waves effectively, to operate an external device sensitive to heat, light and electromagnetic waves.

It is to be understood that I may combine, within the scope of this invention, any of the uses numbered from 1-10, inclusive, with any or all of the uses numbered from 11-17, inclusive.

For instance, use 5 in the foregoing list, alteration of the current of a circuit in which my device is connected, might be employed in conjunction with use 12, radiating light to operate a light sensitive device. Thus, a device might be produced which at one condition of load would produce little or no magnetism, little or no choking action and no light radiation. But, assume that this same load is left connected for a time and that the resistance change elements in the paralleled paths alter the current split therein so that magnetism is set up, a choking action is introduced, and simultaneously the high temperature element begins to radiate light. The light produced may be assumed sufficient to cause the external light sensitive device to function. The increased choking action alters the load current and at the same time, the light radiation device is caused to function. It will be seen, then, in this case, that the circuit load and the light sensitive device are interdependent parts of a single system, and the latter may be arranged to function for any one of several values or durations of loads. Without entering into a series of similar explanations, it will be understood that all of the factors having a bearing on the production of magnetism and resistance change in the electromagnetic device will be interrelated with the energy responsive devices so that changes in the former may be reflected in operation of the latter.

Referring to the drawing, Fig. 1 is a sectional view through a slow electromagnetic device embodying my invention; Fig. 2 is a plan view of the same device as Fig. 1 but includes a diagram of heat, light and magnetic rays radiating to intercepting devices; and Fig. 3 is a view of a modified form of my invention.

In practicing my invention, the greater difference in temperature I can introduce from initial to final condition, the more effective the device. Materials available for very high temperature operation include a number with low temperature coefficients of resistance which can be successfully operated in air at 1000° C., for instance, nichrome, tophet, etc. Pure nickel has a high positive temperature coefficient of resistance and may be successfully operated in air up to approximately 1000° C. In incandescent lamps, however, tungsten is regularly operated at 2000° C. to 2400° C. and in the carbon lamp, the filament is operated at a somewhat lower temperature. It will thus be seen that if conductors are mounted in evacuated or gas filled vessels as in this application, they can be operated at considerably higher temperatures than those available for operation in air.

In my copending application Serial No. 416,877, filed December 27, 1929, I show a tungsten lamp in series with one of the two paralleled windings and a carbon lamp in series with the other. In my Patent No. 1,884,877, dated October 25, 1932, a division of my application Serial No. 416,877, I show both filaments in a single evacuated vessel. In my present invention, I enclose part or all of the windings of my electromagnetic device in an evacuated or gas filled vessel, ordinarily of glass for small current capacities. This results in a self-contained device, the windings of which may be heated to temperatures well above those otherwise practicable.

In Fig. 1 is shown a core 90 of magnetic ma-

terial having mounted on it a winding 91 connected in series with a supply line 118 and a load 117. In parallel with winding 91 there is connected a series circuit made up of a second winding 92 and a high temperature winding 92'. Winding 92' consists of several turns of conductor 95 mounted on supports 93 within an evacuated or gas filled vessel 94. The method of supporting conductor 95 is indicated conventionally and may take any suitable form. A lead-in conductor 96 is joined at 97 to the supply line. Lead-out conductor 102 is connected at 103 to winding 92, the other terminal 104 of which is connected at 105 to the load circuit. This forms the main or primary circuit through the device in parallel with winding 91. The core 90 is arranged to have two magnetic paths. There is a closed magnetic circuit through the center limb 106, and limbs 107 and 108, and limb 109. Mounted on limb 109 is a third winding 110 acting as the secondary of a transformer, that is, it is insulated from all other parts of the device and supplies current to its own local circuit when magnetism is set up in limb 109. The local circuit may include connections 111 and any translating device 112 such as a lamp, relay, motor, etc.

The second magnetic path forming part of core 90 embraces center limb 106 and end limbs 113. The ends of limbs 113 are shaped at 114 to provide clearance and suitable air gaps to permit a rotating armature 115, turning on pivot 116, to pass. The armature 115 is shown as a cam shaped structure of magnetic material whose shape biases it to rotate clockwise when there is sufficient magnetism at poles 114. This is a conventional illustration of a pivoted, rotating or movable structure to be set in motion by magnetism originating in the electromagnetic device, and if replaced by an armature of a motor of any well known type, a sliding core, a pivoted or sliding armature or any other well known construction for translating magnetic action into mechanical work, the magnetism will operate to cause mechanical movement of the movable portions. Electrically the main windings 91, 92 and 92' of the device function to alter the total resistance, inductive reactance and/or power factor of the device, also the magnetism in core 90, all of which effects occur over a time cycle determined by the heating of the windings and their differential changes in resistance as thoroughly explained herein and in the copending patent applications mentioned herein.

If the device is connected in series with a supply source and a load as shown at 117, it may be used to affect the voltage, current and/or power factor of the load circuit. If the device is connected directly across the supply line 118 it may be used electrically to alter the total inductive reactance, resistance and/or power factor of the load connected to said power line over a time cycle. The supply may be direct current, alternating current, pulsating or any other combination. Since its primary functioning is the result of changes in heating of conductors it will function regardless of the type of current supply. On direct current there will be no inductive effects except when the current or magnetism are changing fairly rapidly but otherwise the device will function as described on direct current as with the others. If on alternating current, the device may be made up for use on polyphase currents in ways well understood by those skilled in the art. For simplicity it has been shown for single phase operation.

In Fig. 2 is shown a sectional view on line 2-2, of the device described in Fig. 1 with parts shown partially in side elevation and also showing three additional devices 120, 122, and 124, to be described, added to the view. The purpose of Fig. 2 is to show conventionally the method of utilization of three additional effects obtainable from the same device simultaneously or in time sequence to the effects just described. In Fig. 2 the core 90 carries windings 91, 92, and 92'. If the windings 92' are heated sufficiently, heat begins to be radiated therefrom. The glass structure 94 permits these heat rays to pass freely as indicated at 119. If a device 120 is interposed in the path of the rays and the device is sensitive to and affected by said rays, they may be utilized to operate said device over a time cycle determined by the time cycle of heating of winding 92'. The heat sensitive device may be a thermometer, a thermostatic device or any other suitable well known apparatus. As heating of winding 92' continues a point is reached at which winding 92' passes to a red, and if continued, to a white, heat. Light is now radiated as indicated at 121 and a device 122 sensitive to and operated by light rays may be interposed in these rays to be operated over a time cycle, corresponding to the heating time cycle of winding 92'. This device may be any well known light sensitive cell such as the selenium cell or devices used in the "electric eye" or the photronic cell or photo cell.

The electromagnetic waves generated by the device as a whole, and winding 92' in particular, may radiate as indicated at 123 and be picked up by a device 124 sensitive to such waves to produce a signal or other result dependent on the intensity of the radiation over a time cycle. Apparatus 124 may be a radio receiving set or any other suitable appliance.

Fig. 3 shows a construction of high temperature winding where the winding 72 is cast in glass or other suitable high temperature material or refractory. When cast in glass the conductors will be plainly visible, as the wires are visible in the well known wired window glass. Here 71 is a low temperature winding in parallel with winding 72 across lines 75 and 76. The core 73 has a movable armature 74 magnetically controlled. The casing for the various evacuated or gas filled vessels described may be of glass or porcelain.

In applying my invention I may employ it in connection with any of the electromagnetic apparatus listed, wherever magnetism increases, decreases, or changes over a time cycle. Simultaneously or in time sequence with the magnetic changes the heat, light and electromagnetic waves radiated from the high temperature winding may be caused to operate external devices sensitive to this radiation.

The time sequences in which these effects occur may be varied at will over a wide range. For example, the maximum magnetism may be present when the windings are in their initial cold condition, in which case there would be no light or heat. After the windings heat and are giving off light, the magnetism can disappear; or the reverse can be the case, the light heat and magnetism reaching a maximum together; or the magnetism can start high, with no light or heat, reach zero at an intermediate point with a dim light and moderate heat, and rise again as the light and heat rise to full intensity.

While I have described a number of preferred embodiments of my invention, I do not intend to

limit myself to the exact constructions herein disclosed except insofar as defined by the appended claims.

What I claim as new and desire to secure by

Letters Patent of the United States is as follows:

1. An electromagnetic device comprising two windings connected in parallel one with respect to the other, said windings being effectively coupled magnetically for mutual induction, at least part of one winding being supported in an evacuated vessel and arranged to radiate heat from its high temperature surface, when energized through the walls of said vessel, said walls being formed of material capable of transmitting radiant heat, to alter the temperature of a thermal responsive apparatus external to said electromagnetic device, to effect the operation of said apparatus by changes in said radiant heat.

2. An electromagnetic device comprising two windings connected in parallel one with respect to the other, said windings being effectively coupled magnetically for mutual induction, at least part of one winding being supported in an evacuated vessel and arranged to radiate light from its high temperature surface, when energized, through the walls of said vessel, said walls being formed of material capable of transmitting light, and a light responsive apparatus external to said electromagnetic device, the operation of said light responsive apparatus being effected by change in said radiated light.

3. An electromagnetic device comprising two windings connected in parallel one with respect to the other, said windings being effectively coupled magnetically for mutual induction, at least part of one winding being supported in an evacuated vessel and arranged to radiate electromagnetic waves from its high temperature surfaces, when energized, through the walls of said vessel, said walls being formed of material capable of transmitting electromagnetic waves into an electromagnetic wave receiver external to said electromagnetic device, to effect the operation of said receiver by changes in the intensity of said electromagnetic waves.

4. An electromagnetic device comprising two windings connected in parallel one with respect to the other, said windings being effectively coupled magnetically for mutual induction, at least part of one winding being supported in a vessel and arranged to radiate heat and light from its high temperature surfaces, when energized, through the walls of said vessel, said walls being formed of material capable of transmitting radiant heat and light, and a heat and light responsive apparatus external to said electromagnetic device, means to produce disproportionate changes in resistance and current in said paralleled windings with temperature changes therein, constituting means to alter the radiant heat and light over a time period, and to effect the operation of said heat and light responsive apparatus over a time period.

5. An electromagnetic device comprising two windings connected in parallel one with respect to the other, said windings being effectively coupled magnetically for mutual induction, at least part of one winding being supported in a vessel and arranged to radiate heat and electromagnetic waves from its high temperature surfaces, when energized, through the walls of said vessel, said walls being formed of material capable of transmitting radiant heat and electromagnetic waves, and heat and electromagnetic wave responsive apparatus external to said electromag-

netic device, means to produce disproportionate changes in resistance and current in said parallel windings with temperature changes therein, constituting means to alter the radiant heat and electromagnetic waves over a time period, and to effect the operation of said heat and electromagnetic wave responsive apparatus over a time period.

6. An electromagnetic device comprising two windings connected in parallel one with respect to the other, said windings being effectively coupled magnetically for mutual induction, at least part of one winding being supported in a vessel and arranged to radiate light and electromagnetic waves from its high temperature surfaces, when energized, through the walls of said vessel, said walls being formed of material capable of transmitting light and electromagnetic waves, and light and electromagnetic wave responsive apparatus external to said electromagnetic device, means to produce disproportionate changes in resistance and current in said paralleled windings with temperature changes therein, constituting means to alter the radiant light and electromagnetic waves over a time period, and to effect the operation of said light and electromagnetic wave responsive apparatus over a time period.

7. An electromagnetic device comprising two windings connected in parallel one with respect to the other, said windings being effectively coupled magnetically for mutual induction, at least part of one winding being supported in a vessel and arranged to radiate heat, light and electromagnetic waves from its high temperature surfaces, when energized, through the walls of said vessel, said walls being formed of material capable of transmitting heat, light and electromagnetic waves, and heat, light and electromagnetic wave responsive apparatus external to said electromagnetic device, means to produce disproportionate changes in resistance and current in said paralleled windings with temperature changes therein, constituting means to alter the radiant heat, light and electromagnetic waves over a time period, and to effect the operation of said heat, light and electromagnetic wave responsive apparatus over a time period.

8. An electromagnetic device comprising two windings connected in parallel one with respect to the other, said windings being effectively coupled magnetically for mutual induction, at least part of one winding being supported in an evacuated vessel and arranged to radiate heat, light and electromagnetic waves from its high temperature surfaces, when energized, through the walls of said vessel, said walls being formed of material capable of transmitting heat, light and electromagnetic waves, and heat, light and electromagnetic wave responsive apparatus external to said electromagnetic device, means to produce disproportionate changes in resistance and current in said paralleled windings with temperature changes therein, constituting means to alter the radiant heat, light and electromagnetic waves over a time period, and to effect the operation of said heat, light and electromagnetic wave responsive apparatus over a time period.

9. An electromagnetic energy radiating device comprising two windings connected in parallel one with respect to the other, said windings being effectively coupled magnetically for mutual induction, at least part of one of said windings arranged for operation at elevated temperature

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in an evacuated vessel having walls of material
permitting radiation of energy therethrough,
means for energizing said device to produce ra-
diant energy emanating from said high tempera-
5 ture winding, said radiation being variable over
a time cycle by means of changes in currents in
said paralleled paths, and in combination, energy

receiving means responsive to radiant energy,
said variable radiant energy constituting means
to operate said energy receiving means in ac-
cordance with energy radiation from said electro-
magnetic means.

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