

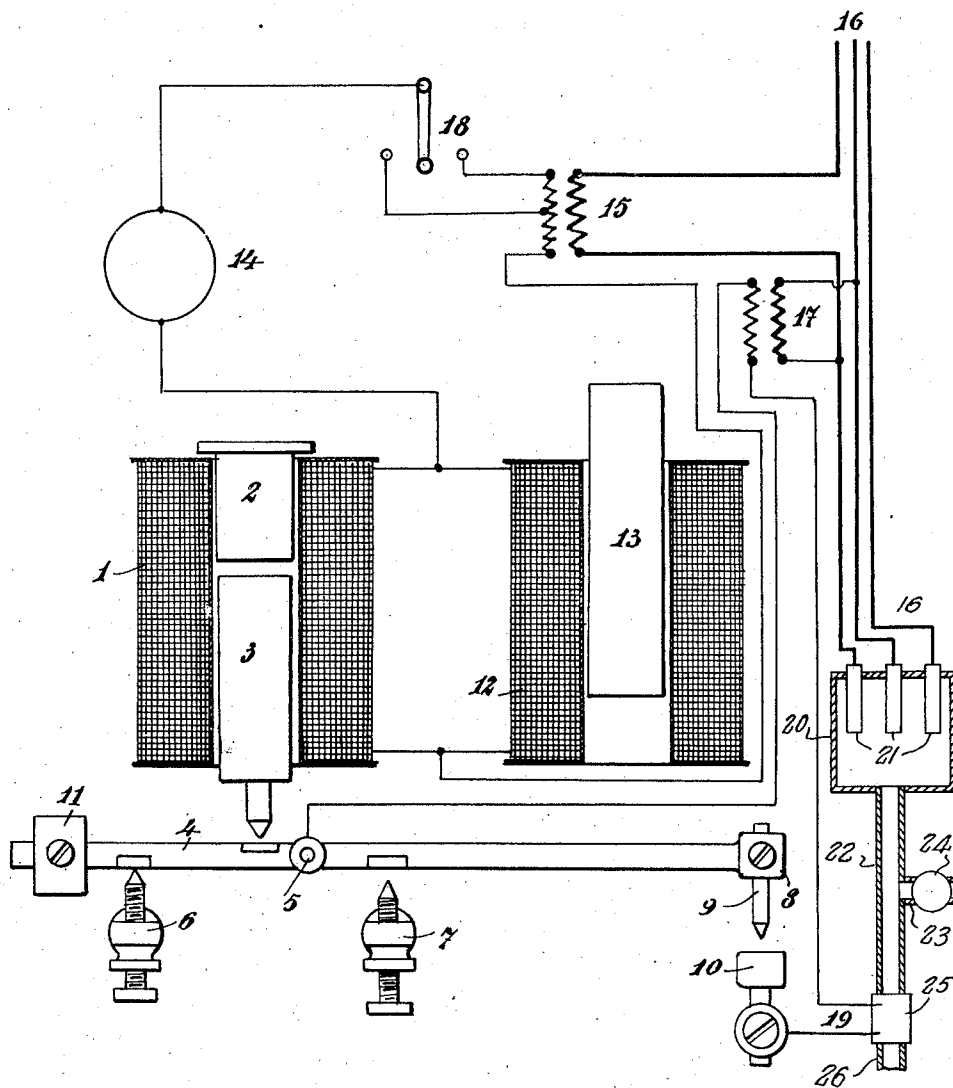
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AUTOMATIC CONTROL FOR ELECTRIC STEAM BOILERS

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AUTOMATIC CONTROL FOR ELECTRIC STEAM BOILERS

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The present invention has for its subject matter an electromagnetic relay closing and opening an electric circuit for two values of an electric current to be controlled lying in close vicinity to one another.

The figure attached illustrates the principle on which the invention is founded as well as one of the various practicable execution forms for carrying such a principle into effect.

With reference to the figure, 1 is a coil having inside a stationary iron core 2 and a travelling iron core 3. When the travelling core 3 is not sucked in, it rests on one arm of a two armed lever 4 swinging about the pivot 5, whose other arm carries a contact element 9, whereas at the opposite lever end a sliding counterweight 11 is fitted. The length of the two lever arms is so proportioned that the couple due to the contact 9 is somewhat in excess of the couple due to the counterweight 11.

Across the ends of the coil 1 a second coil 12 is connected, a travelling iron core 13 being arranged inside of this second coil.

The set comprising the two coils and eventually an amperemeter 14 is traversed by the current to be controlled or by a current proportional to the said current and supplied, for instance, by a transformer 15 provided on the line 16.

The contacts 9—10 close and open an auxiliary circuit 19 which may eventually be supplied with current from a transformer 17 at a suitable pressure.

The working of the arrangement is as follows:

When the current traversing the coil 1 has attained a predetermined value depending from the characteristics of said coil, the travelling core 3 is sucked in and comes into contact with the stationary core 2. The lever 4, being now released from the weight of the core 3, will swing about its pivot 5 and close the auxiliary circuit 19 at 9—10, thus actuating the signalling and automatic adjustment devices.

When due to the effected adjustment or through any other cause whatever the current sinks to a certain value below its previ-

ous value, the travelling core 3 detaches itself from the stationary core 2 and weighting down the lever 4 will cause the lever to swing in opposite direction to the previous one so as to open the auxiliary circuit 19 at 9—10.

The degree of sensitiveness of the relay, that is to say the difference between the two current values for which the suction and release of the travelling core take place, varies with the length of the core stroke and can be set to any desired value by means of the regulating screw 6, this screw acting on the lever 4 to the effect of limit the amplitude of its swinging and therewith the downward stroke of the core 3.

The adjustable screw 7 is intended to suitably limit the oscillations of the lever 4 to the effect of allowing it to close the contacts 9—10 but at the same time preventing it from following the travelling core 3 through the whole upward stroke. In this manner an interstice will be left between the upward moving core 3 and the lever 4, so that the core vibrations will be prevented from transmitting themselves to the lever 4 and contacts 9—10, such vibrations being obviously noxious.

When the set comprising the coil 1, cores 2 and 3 and adjustable screws 6 and 7 has been established in its various elements, the suction and release of the core 3, and consequently the closing and opening of the auxiliary circuit 19 at 9—10, will take place for two predetermined values of the current to be controlled.

In order to enable the apparatus to operate for different values of the current to be controlled, the coil 12 shunted on the coil 1 is provided. As the current traversing the apparatus divides itself over the two coils in reverse ratio to their apparent resistances, by varying the reactance of the coil 12 through displacement of its core 13, the current flowing through the coil 1 can be caused to remain steady on its normal working value, that is to say the relay can be made to operate for different values of the current to be controlled, these values being comprised between two limits depending from the electric and magnetic characteristics of the two coils.

Should it be desired to increase the control range, a transformer 15 with two or more degrees of sensitiveness, viz., with two or more transformation ratios, may be provided, the apparatus being inserted on one or the other of the different circuits by means of a change-over switch 18.

The coil 12 fitted with travelling iron core may be replaced by a suitably adjustable ohmic or mixed (ohmic and inductive) resistance; the effect would be the same.

The drawing relates to one mode only of carrying the devised apparatus into practice; it will be clear that the form, arrangement and method of grouping the various parts may be altered to suit the different cases.

In the description we have spoken only of the "current" control. It will be readily understood, however, that the adoption of watt-metric and pressure windings would permit the control of the effective load on a line or of the potential difference between two points.

The apparatus as described is especially adapted to the control of electric steam boilers of the electrode type. In the drawing, an electric steam boiler 20 has electrodes 21 contained therein, these electrodes are each connected to the mains 16. Said boiler has connected thereto a pipe 22 for feeding or discharging water from the boiler depending upon the conditions existing in auxiliary circuit 19. Said pipe 22 is connected to a feed water pipe 23 through which water is forced into boiler 20 by means of pump 24. Pipe 22 is also connected to an electrically operated valve 25, which controls the discharge of water from the boiler through the discharge pipe 26 and which is adapted to be electrically connected to auxiliary circuit 19. Valve 26 is normally closed and is opened only when auxiliary circuit 19 is energized.

The operation of this control system is such that when the water in the boiler reaches a certain predetermined level a predetermined load is placed on the mains 16. When sufficient power passes through the coil 1 the movable core 3 is lifted thereby causing lever 4 to swing in a clockwise direction and close contacts 9 and 10. The auxiliary circuit and valve 25 will be energized or deenergized depending on the desired electrical load on the boiler. Since a water level in the boiler higher than that which has been predetermined will result in a greater wetted electrode surface more power will pass through the mains 16 and movable core 3 will be raised closing contacts 9 and 10 and opening valve 25 to decrease the wetted electrode surface so that only the predetermined amount of power will be maintained in the mains 16.

The critical power for raising the core 3 is supplied only when the water in the boiler has reached the predetermined level, this power may also be secondarily varied by ad-

justment of the traveling core 13 when it is desired to maintain a different load on the boiler.

In the case of electric steam boilers, when the adjustment is carried out through operation of movable elements, the auxiliary circuit 19 may be caused to operate an electric motor or any other device manipulating the said movable elements.

The apparatus according to the invention may be inserted, either directly or through the intermediary of a transformer, on the feed line of an electric current distribution system, and may be used to vary the load or the current absorbed by the boiler in such a manner as to maintain constant the load or current respectively of the general line, in other words, in such a manner as to cause the boiler to absorb all the load or current respectively that at any given moment remains available. In this manner a rectilinear diagram is realized, within the limits of the load and current which the boiler according to its construction is capable to absorb.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. Appliance for the regulation of water admission and water level in electrically heated boilers furnished with electrodes, for the purpose of regulating and limiting the current intake rate of the boiler, characterized in that the current to be regulated excites two solenoids connected in parallel relation to each other, of which one has a fixed core and a movable core which in a demagnetized condition is supported on a lever arm and maintains an auxiliary electrical circuit open while in the magnetized condition it frees the lever through whose turning the circuit is closed, the second solenoid being an inductive resistance with movable iron core, through whose movement, owing to change in current distribution between the two solenoids, the magnetic effect of the first solenoid is adjustable to different values of the current to be regulated.

2. Device according to claim 1 wherein on closing the auxiliary circuit, a current opens a valve provided on the feed pipe of the boiler so that the water supplied by the feeding device and, if necessary, also a part of the water present in the boiler is led away, and by displacement of the core of the second solenoid the level of the water present in the boiler is limited to a value which corresponds to the current consumption for which the device is calibrated, while on opening the secondary circuit, the valve is closed and makes possible the feeding of the boiler.

3. Device according to claim 1 characterized in that a screw, against which the lever influenced by the weight of the movable core rests, permits the regulation of the throw of

the lever and thereby the stroke of the core and the sensitivity of the device.

4. Device according to claim 1 characterized in that a screw limits the movement of the lever influenced by the weight of the movable core in such a way that the lever is so far released from the completely aspirated core that the latter cannot transmit the oscillations produced by the alternating current to the former.

Signed at Milan (Italy), this 13th day of Jan., 1927.

GIOVANNI MASCARINI.