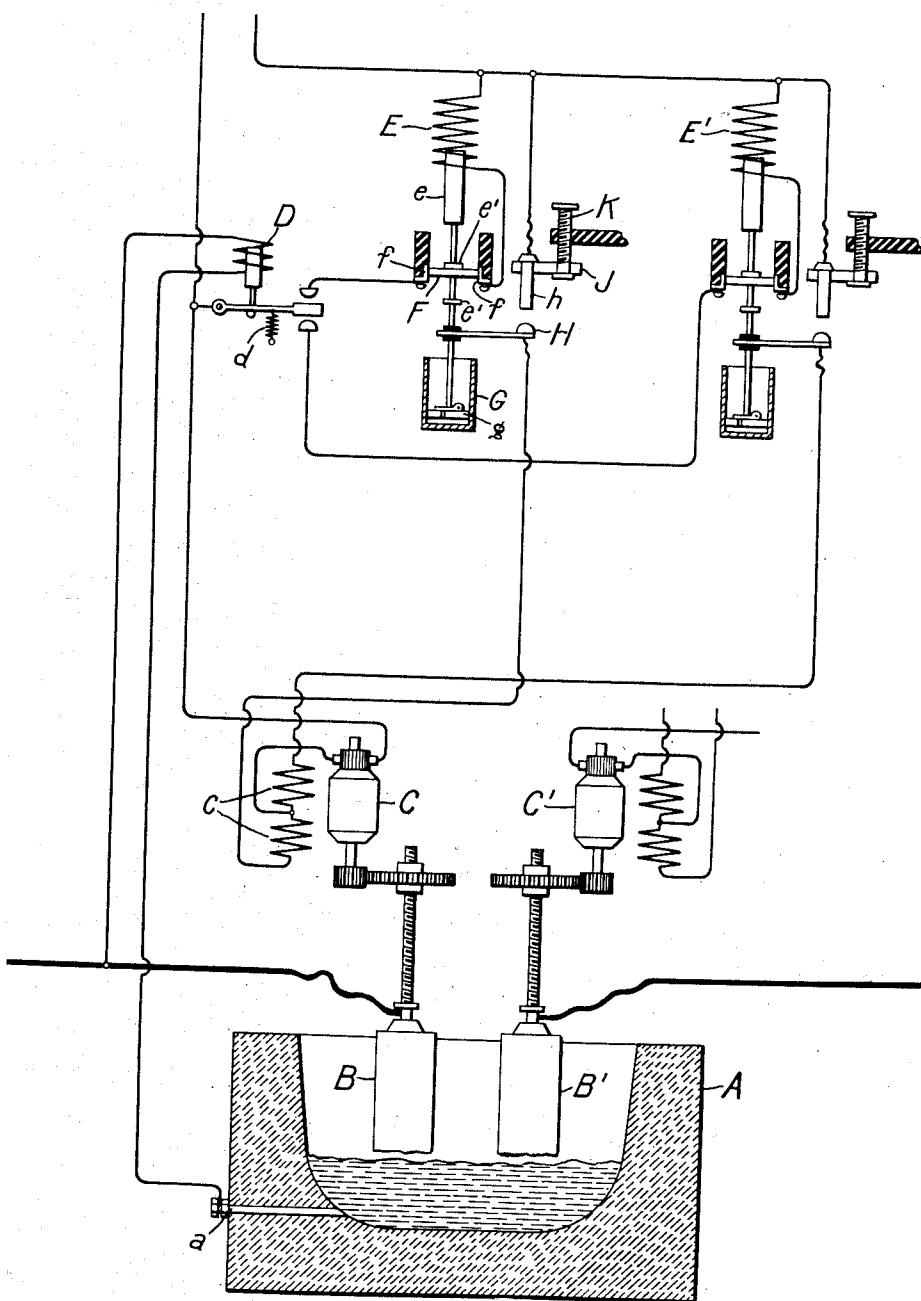


J. A. SEEDE.
ELECTRIC FURNACE.
APPLICATION FILED DEC. 2, 1909.

1,042,613.

Patented Oct. 29, 1912.



Witnesses
J. Earl Ryan
J. Ellis Glen.

Inventor.
John A. Seede
by *Alfred H. Davis*
His Attorney.

UNITED STATES PATENT OFFICE.

JOHN A. SEEDE, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC FURNACE.

1,042,613.

Specification of Letters Patent.

Patented Oct. 29, 1912.

Application filed December 2, 1909. Serial No. 531,004.

To all whom it may concern:

Be it known that I, JOHN A. SEEDE, a citizen of the United States, residing at Schenectady, in the county of Schenectady and State of New York, have invented certain new and useful Improvements in Electric Furnaces, of which the following is a specification.

My invention relates to the control of arc electrodes for electric furnaces, and its object is to provide a novel arrangement of the control apparatus, such that certain difficulties experienced heretofore are eliminated.

In many furnaces, especially those of the arc type, where the electrode is suspended over the bath, there is considerable difficulty experienced in securing close regulation, because of the inertia of the electrodes and other moving parts, which results in "over-running," so that a kind of hunting action is produced which interferes seriously with the operation of the furnace.

By my invention this over-running tendency is done away with. I obtain this result by providing, in addition to the usual motor controlling means responsive to variations in the arc, a device for automatically and intermittently at predetermined intervals opening and closing the motor circuit when the arc-responsive means operates. This arrangement results in actuating the motor through a series of impulses, the motor being started, then stopped, then started again, so that the electrode is brought slowly to the desired position and has very little tendency to over-run that position.

My invention will best be understood by reference to the accompanying drawing which shows diagrammatically a motor control system for the electrodes of an electric furnace arranged in accordance with my invention.

In the drawing, A represents an electric furnace having two movable electrodes B, B', suspended over the bath in the furnace. These electrodes are provided with electric motors C, C' for moving them. The motor C is connected to the electrode B through a suitable form of speed reducing gearing. I have indicated a gear, driven by the motor, acting as a nut to raise and lower the screw-threaded rod carrying the electrode B. The motor C is provided with a double field

winding *c*, so that by cutting one-half or the other of the field winding into circuit the motor is operated in one direction or the other to raise or lower the electrode.

D represents a device responsive to arc variations of voltage or current, or both. I have indicated in the drawing a magnet connected in shunt to the arc of the electrode B by means of an iron rod *a*, or other suitable terminal, extending into the interior of the furnace. When the electrode B is in the proper position the pull of this magnet D on its plunger is balanced by a spring *d*, so that both upper and lower contacts of this magnet are open. E and E' represent magnets controlled by the device D and controlling the operation of the motor. It is these magnets which serve to open and close the motor circuit intermittently when the magnet D closes its contacts. One of the magnets E, E' comes into play when the motor is raising the electrode and the other when the motor is lowering the electrode. The plunger *e* of each of these magnets actuates a contact F by means of a lost motion connection consisting of collars *e'*, *e'* adapted to engage and shift the contact F when the plunger is raised and falls. The contact F when in the position shown bridges two contacts *f*, *f*. This contact remains in whatever position it may be moved to by either collar *e'* until it is engaged by the other collar and moved to its other position. Attached to the lower end of the rod carried by the plunger *e* is the piston *g* of the dash-pot G. This piston is arranged to retard the upward movement of the plunger and to permit a free downward movement. The plunger also carries a contact H which, when the plunger is raised, engages a contact *h* which is supported by the stationary member J but which is free to move upward when engaged by the contact H so as to permit a further movement of the plunger after the contacts H and *h* have been brought together. The height of the member J and, consequently the initial distance between contacts H and *h* may be adjusted by the screw K. The contacts H and *h* thus constitute a switch for closing and opening the motor circuit.

As long as the voltage across the arc of the electrode B remains normal the contact of magnet D remains in mid position and the motor circuit is open. If the voltage

across the arc rises above its proper value, the magnet D draws up its plunger against the tension of spring *d* so as to close its upper contact. A circuit is then closed
 5 through magnet E, contact F and the contact of magnet D. The magnet E is, therefore, energized and draws up its plunger *e* slowly, since it is retarded by the dash-pot. The contact F is not moved at first but contact H is soon brought into engagement with
 10 the contact *h*, thereby closing the circuit of motor C through the lower half of its field winding *c*. The motor accordingly starts and lowers the electrode B. The upward
 15 movement of plunger *e* continues, the contact *h* being carried upward so as to permit this movement, until the lower collar *e'* engages contact F and moves it out of engagement with the contacts *f f*. The circuit
 20 of magnet E is thus broken and the plunger falls breaking the motor circuit at H and *h*. Contact F is not returned to its original position until after the motor circuit is broken and the upper collar *e'* engages the contact
 25 F and returns it to the position shown. Then if the upper contact of magnet D is still closed the magnet E again draws up its plunger and the same operation takes place in the sequence that has just been described.
 30 This continues until the electrode B is lowered sufficiently to bring the arc voltage to its proper value. If the arc voltage should fall below its proper value, the pull of magnet D would be weakened and its lower con-
 35 tacts closed by the tension of spring *d*. This closes the circuit of magnet E' which opens and closes the motor circuit precisely in the manner that has been described for magnet E, except that now it is the upper half of
 40 the field winding of motor C which is energized, so that the electrode B is raised by a series of impulses until the voltage across the arc rises to a proper amount. By means of the intermittent opening and closing the
 45 motor circuit, the electrode is moved gradually without a tendency to over-run.

The magnets D, E and E' jointly control the motor C. For the control of the motor C' a similar arrangement of magnets would

be provided. The control magnets for motor C' have been omitted from the drawing for the sake of simplicity.

I do not desire to limit myself to the particular construction and arrangement of parts shown and described, but aim in the
 55 appended claims to cover all modifications which are within the scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is,

1. In combination with a movable arc
 60 electrode, an electric motor for moving the electrode, means for controlling said motor responsive to variations in the arc, a magnet controlled by said means, a contact operatively connected to the plunger of said
 65 magnet in circuit with said motor, a contact in circuit with the magnet winding connected to the plunger of said magnet through a lost motion connection, and means for retarding the movement of said plunger. 70

2. The combination of an electric motor, means for controlling said motor, a circuit-closing magnet having a plunger provided with a lost motion device, a switch operatively connected to said plunger and in circuit
 75 with the motor, a contact in circuit with the magnet winding operatively connected to the lost motion device whereby the magnet circuit is automatically opened and the motor deenergized for predetermined inter- 80 vals.

3. The combination of an electric motor, means for controlling said motor, a switching magnet controlled by said means, a
 85 switch in-circuit with said motor, operatively attached to the plunger of said magnet, one of the contacts of said switch yielding so as to prolong the time of contact, a contact in circuit with the magnet winding whereby its circuit is automatically opened
 90 by the movement of its plunger, and means for retarding the motion of the plunger.

In witness whereof, I have hereunto set my hand this first day of December, 1909.

JOHN A. SEEDE.

Witnesses:

BENJAMIN B. HULL,
 HELEN ORFORD.