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ELECTRIC FURNACE.

APPLICATION FILED MAR. 20, 1908.

955,655. **Patented Apr. 19, 1910.**

Fig. 1

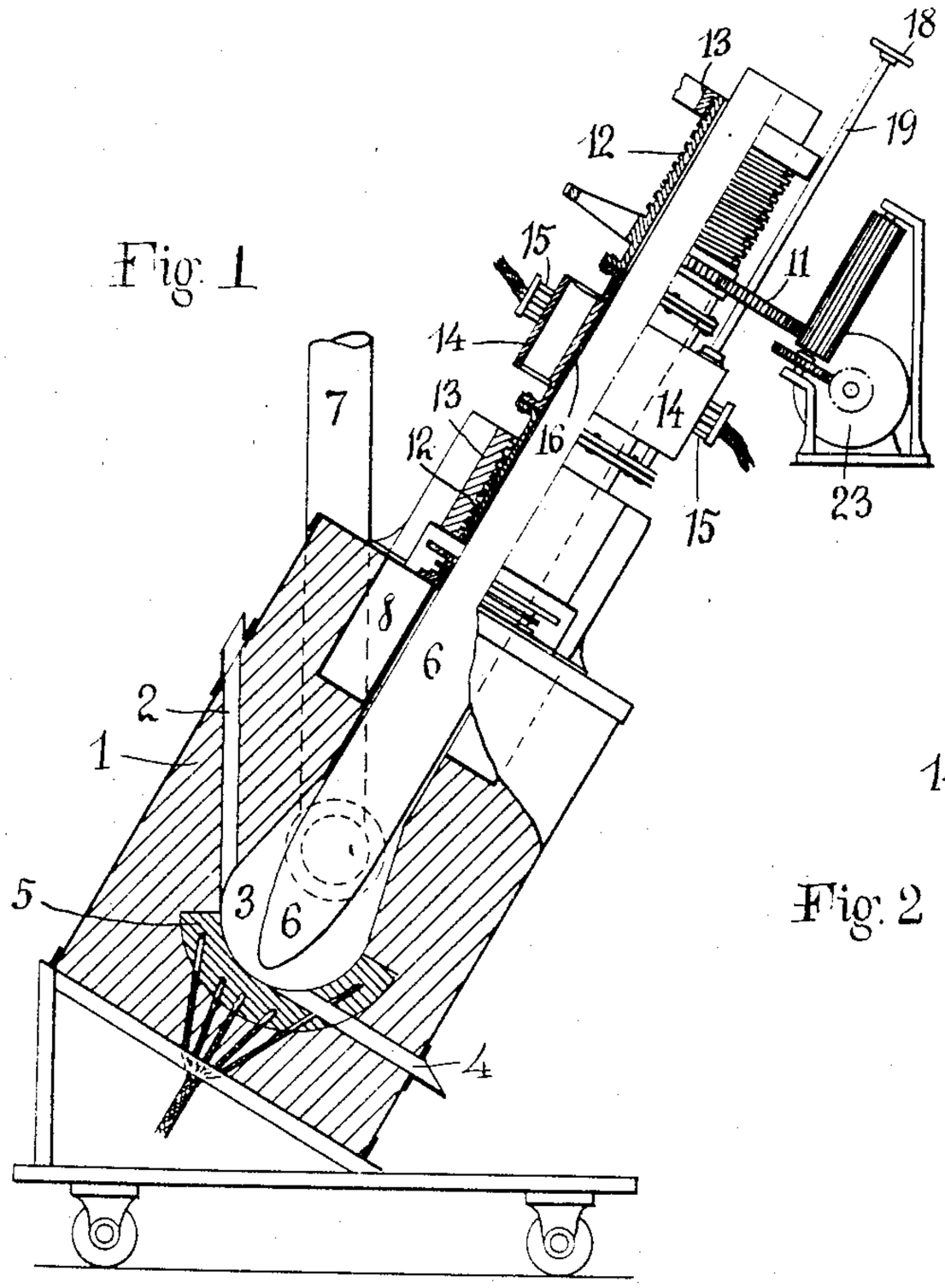

Fig. 3

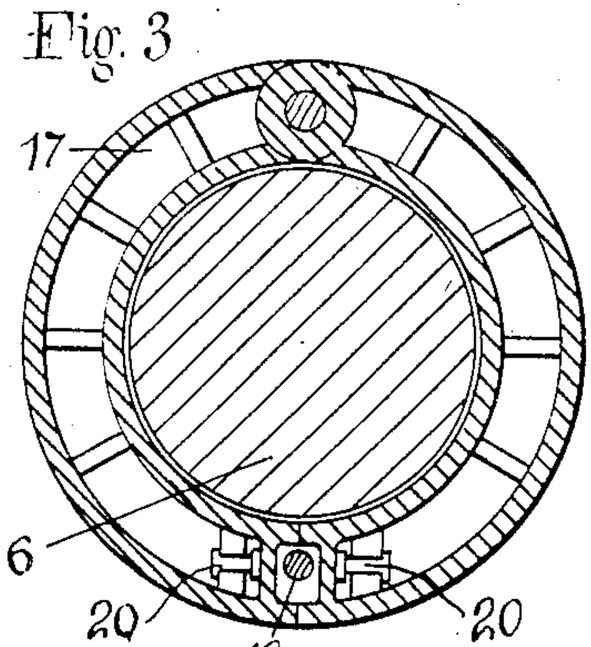

Fig. 2

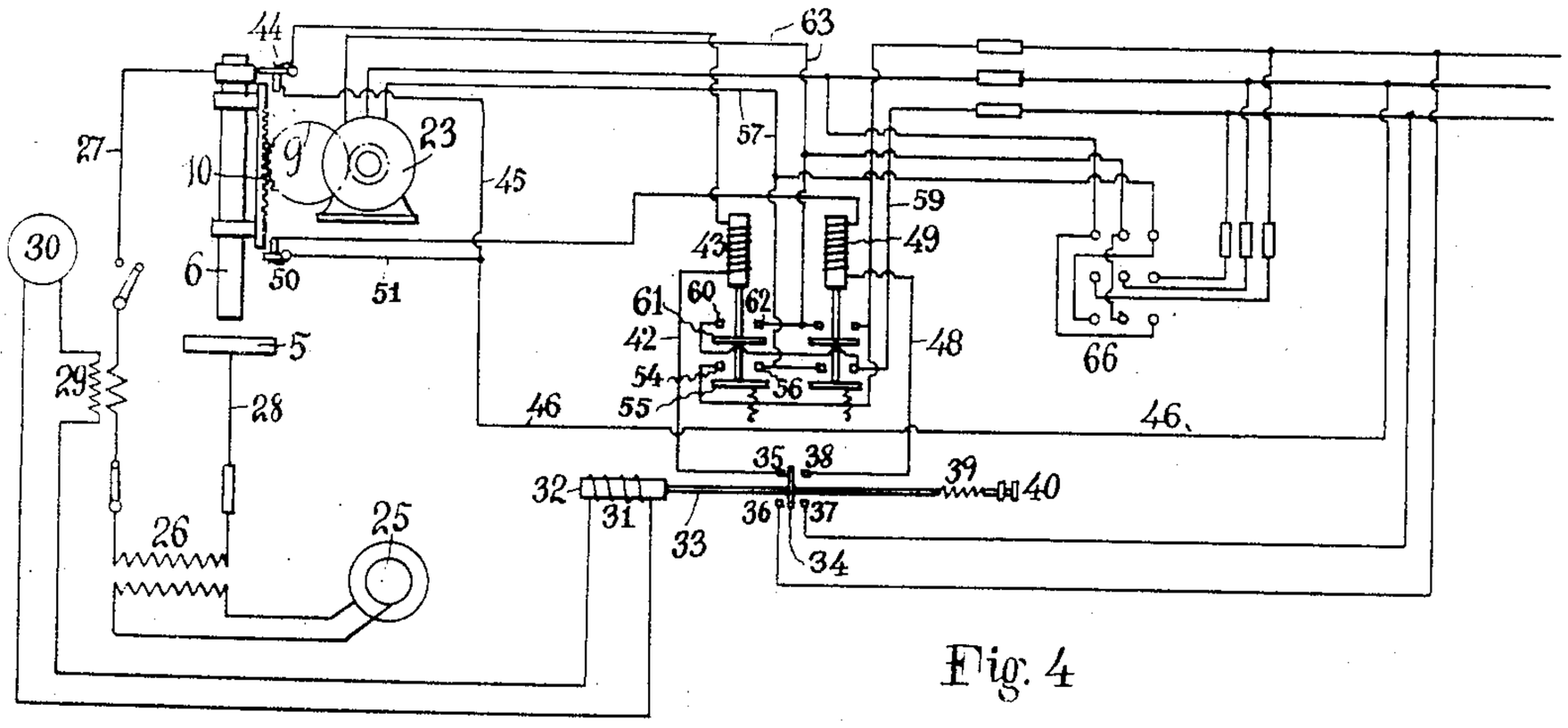

Fig. 4

Witnesses
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UNITED STATES PATENT OFFICE.

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ELECTRIC FURNACE.

955,655. Specification of Letters Patent. Patented Apr. 19, 1910.

Application filed March 20, 1908. Serial No. 422,239.

To all whom it may concern:

Be it known that we, EINAR H. MEYER and JOB MORTEN AUGUST STILLESEN, subjects of the King of Norway, residing at Niagara Falls, in the Dominion of Canada, have invented certain new and useful Improvements in Electric Furnaces, of which the following is a full, clear, and exact specification.

This invention relates to electric furnaces and method of operation, and more particularly has reference to improvements in the construction of such furnaces, whereby the charge may be supplied and the furnace controlled in a more reliable and accurate manner than has heretofore been the case.

The invention further has particular reference to a controlling system for electric furnaces whereby the relative distance between the electrodes is automatically controlled according to the amount of current taken by the furnace, which varies according to the resistance and condition of the charge, or other operating conditions.

The invention further has reference to improvements in the details of construction of an electric furnace, whereby the charge may be introduced at the bottom of the furnace instead of at the top, and in the mounting of the movable electrode whereby it can be automatically moved toward and from the fixed electrode, and also rotated on its axis, to insure even wear and thereby maintain the efficiency of the furnace.

The invention will be more fully understood in connection with the description of the accompanying drawings, wherein—

Figure 1 is a vertical cross-section of a furnace embodying the invention, Fig. 2 is a detail view showing the means for connecting the electrode; Fig. 3 is a cross section, and Fig. 4 is a diagram of the electrical circuits for controlling the movable electrode.

1 is an inclined furnace for the purpose of enabling a charge to be applied through a vertical feed hole 2 directly at the bottom of the chamber 3, thus directly exposing the charge upon its introduction, to the greatest heat of the furnace, giving the best efficiency. The material is tapped from the side through the tapping hole 4 in such a way as to tap from the bottom of the furnace. The bottom electrode 5 preferably has a bowl shape, so as to center its action as much as possible in relation to the bottom point of the top electrode 6. The monoxid gas is carried away through piping 7, as near as possible to the surface of the charge, and the upper part of the furnace is cooled by introducing air in a cylinder 8 around the electrode. The top electrode 6 can either be given a straight up and down movement, as shown, by means of gear 9 and rack 10 carried by the electrode, Fig. 4, or it can also be given a rotating movement, as well as an up and down motion, by means of gear 11 and threads 12 carried by the electrode, the threads working in a fixed nut 13, which also guides the electrode. The electrical contact is made on the copper cylinder 14, which latter is fastened to the electrode and rotates with same. The current is conducted to the cylinder 14 by means of brushes 15, which may be arranged in a manner to suit the capacity of the furnace. These brushes are stationary and exert a sufficient pressure on the cylinder to give a good contact on same. The cylinder 14 is lined with copper gauze 16 on the side next to the carbon so as to insure the best possible contact between the carbon and the clamp. This is particularly desirable on account of the fact that carbons may differ somewhat in size. The whole clamp 17 (Figs. 2 and 3) is hinged and arranged to open and close by hand control through hand wheel 18 on rod 19, which latter actuates a wedge fork 20 through thread 21 to open or close the clamp 17 according to the way of rotation of the hand wheel 18. This is desirable particularly on smaller furnaces where the shifting of the carbons, due to the wearing down of the same, is more frequent than on furnaces of larger capacity. Suitable insulation will be used where necessary, and also packing rings to prevent the escape of gas around the electrode, at the top of the furnace.

In order to automatically control the movable electrode according to the condition of the charge, a motor 23 is geared directly to the gear 9, in Fig. 4, where the electrode has only a reciprocatory movement, or to gear 11 in Fig. 1, and the current to the motor is regulated and thereby the position of the movable electrode determined.

Referring now to Fig. 4, 25 represents the primary generator, 26 the transformer having its secondary connected by wires 27, 28,

with the respective electrodes 6, 5. 29 is a transformer, in the secondary of which is an ammeter 30, and a magnet switch coil 31, actuating a core 32 on rod 33, and a switch 34 moving between terminals 35, 36, 37, 38. The rod is pulled in one direction by a spring 39, having a tension adjustment 40, according to the strength of the current in the circuit of coil 31, which is determined by the current flowing through the furnace between the electrodes. From contact 35, wire 42 leads through magnet switch coil 43, to terminal switch 44, which is opened when the movable electrode reaches one extreme position, to stop the motor, thence out by wires 45, 46, to the middle wire of the three phase motor circuit. From contact 38, wire 48 leads to coil 49, to opposite terminal switch 50, and by wire 51 to middle wire 46. The coils 43 and 49 control the motor circuits to cause it to go in one or the other direction according to which coil is energized by switch 34. Assuming coil 43 energized, the motor circuits are by middle wire direct, from upper wire to contact 54, bar 55, contact 56, wire 57. Also there is a third circuit to the motor from the lower wire by wire 59, contact 60, bar 61, contact 62, wire 63, starting the motor so as to lift the electrode as the current through the furnace increases in strength. When the electrode reaches the upper end, switch 44 opens to stop further movement by deënergizing coil 43 and opening the motor circuit but not preventing downward movement when the spring 39 closes contacts, 34, 37, to reverse the motor upon weakening of the main current, which energizes coil 49 and reverses the motor to bring the electrodes closer together. At the inner end, switch 50 opens to stop the motor. These end stop switches are not actuated every time the motor moves the electrode, as the movement will frequently be only the slight distance necessary to adjust the resistance, and the switches 43 or 49 will either open by gravity, upon weakening of their respective coils, or release springs, properly adjusted, similar to spring 39 will be provided. Other forms of motor stopping mechanism may be used, but with proper adjustment and proportioning of parts, the position of the electrode will be automatically controlled by the current flowing through the furnace.

The invention is particularly applicable to a furnace for making calcium carbid wherein a charge composed of carbon and limestone mixed in proper proportions is used. As soon as the charge goes over into calcium carbid, it becomes a conductor thereby reducing the resistance, and when the whole charge has gone over, the maximum current will flow through the furnace. As the current flow increases, the coil 31 thus becomes stronger, and the electrode 6 is moved away from electrode 5, until the increased resistance cuts down the current flow until the coil 31 and spring 39 balance each other, thereby opening switch 34 and stopping the motor. If the current flow still further decreases, spring 39 closes switch 34 and starts the motor by energizing coil 49 to bring the electrodes closer together, increasing the current flow by diminution of resistance and strengthening coil 31 until it overcomes spring 39 and stops the motor by deënergizing coil 49. Instead of stopping the motor to prevent overtraveling of the electrode, it may carry stops which strike abutments positioned at proper points. The electrode is also automatically moved, as it wears away, since wearing away tends to increase the resistance and cut down the current, thus starting the motor and moving the electrode to reduce the resistance.

It may be desirable to operate the movable electrode independently of the automatic devices, and this can be accomplished by means of a three-pole double throw reversing switch 66, which can be thrown in one or the other position to control the direction of rotation of the motor.

From the foregoing description, it is thought that the operation of the invention will be fully understood.

While only one electrode is herein shown as movable, it will be obvious that the invention, in so far as it relates to a movable electrode and the control thereof, may be applied to a furnace whereby both electrodes are movable.

In ordinary arc furnaces, if the charge is not properly fed into the furnace, it is liable to become clogged, and the material is not properly distributed around the electrode. By means of the furnace herein described having an inclined and a bowl shaped electrode, the charge is fed in adjacent the bottom of the furnace beneath the end of the upper electrode, and at the hottest part thereof, so that a better distribution of material around the electrode is secured, and increasing the efficiency of the furnace.

By this invention, and the manner of feeding the charge, the wear on the electrode is more even, but uniformity of wear will be insured by the rotation of the electrode as herein described. Furthermore, by the method of control herein described, wherein the resistance is maintained constant, a more uniform product is obtained, and with less cost and expense in manufacture.

Modifications and changes may be made in the specific construction herein described without departing from the scope of the invention.

Having thus described our invention, we declare that what we claim as new and desire to secure by Letters Patent, is:

1. An electric furnace having a bottom

electrode, an inclined top electrode, and means for securing uniform wear of said inclined electrode.

2. An electric furnace having an inclined electrode, a lower electrode disposed at the bottom of the furnace, said lower electrode having a recess adapted to contain molten product, means for maintaining an arc between said electrodes, and means for feeding the charge directly by gravity into said arc.

3. An electric furnace having an inclined and movable electrode, a lower electrode disposed at the bottom of the furnace, said lower electrode having a recess adapted to contain molten product, a means for maintaining an arc between said electrodes, and means for feeding the charge directly by gravity into the said arc.

4. An electric furnace comprising an inclined top electrode, a recessed bottom electrode, and having a charging passage discharging under the point of the top electrode.

5. An electric furnace comprising an inclined top electrode, a recessed bottom electrode, and having a charging passage discharging under the point of the top electrode and a tapping orifice leading from the bottom.

6. An electric furnace comprising an inclined chamber, and having a longitudinally movable and axially rotatable electrode projecting into said chamber.

7. An electric furnace having a bowl shaped bottom electrode, an inclined upper electrode, and means for securing uniform wear of the inclined electrode.

8. An electric furnace having a bottom electrode, an inclined top electrode projecting downwardly toward the bottom electrode, and means for maintaining the top electrode symmetrical.

9. An electric furnace comprising an inclined retaining chamber having a bottom electrode, an inclined top electrode centrally disposed in said inclined chamber, and means for maintaining the end of the electrode conical in form.

10. An electric furnace having a bottom electrode, an inclined retaining chamber containing said electrode, an inclined top electrode, and means for rotating the inclined electrode to maintain its end conical.

11. An electric furnace having a bottom electrode, an inclined top electrode, means for rotating the inclined electrode to maintain its end conical, and means moving the electrode longitudinally according as the conductivity of the charge varies.

12. An electric furnace having a bottom electrode, an inclined top electrode, means for rotating the top electrode, and a charging means opening through a wall of the furnace above the point of the inclined electrode and discharging fresh material by gravity into the space between said electrodes.

13. In an electric furnace, means including an inclined upper electrode for forming an arc, means for rotating said electrode, means for feeding the charge by gravity directly into said arc, means for forming a molten mass in the region of said arc, and means for tapping the furnace from the region of the arc.

14. In an electric furnace, means including an inclined upper electrode and an electrode at the bottom of the furnace for forming an arc, means for maintaining an arc between said electrodes, means for rotating the upper electrode, means for feeding the charge by gravity directly into said arc; and means adapted to tap from the bottom of the furnace.

15. The combination in an electric furnace with a bottom negative electrode, of an inclined positive electrode, and means for axially rotating said positive electrode.

16. The combination in an electric furnace with a bottom negative electrode, of an inclined positive electrode, and means for rotating and automatically feeding said positive electrode.

17. The combination in an electric furnace with a recessed bottom electrode of negative polarity, of an inclined positive electrode projecting toward said recessed electrode, and means for axially rotating said positive electrode.

In testimony whereof we affix our signatures, in presence of two witnesses.

EINAR HONORATUS MEYER.
JOB MORTEN AUGUST STILLESEN.

Witnesses:
HARRY MARSEY,
AUGUSTUS LOTZAR.