No. 615,346. Patented Dec. 6, 1898.

W. L. DENIO.

SMOKE CONSUMER.

(Application filed May 11, 1898.)

(No Model.)

2 Sheets---Sheet 1.

Fig. 1.

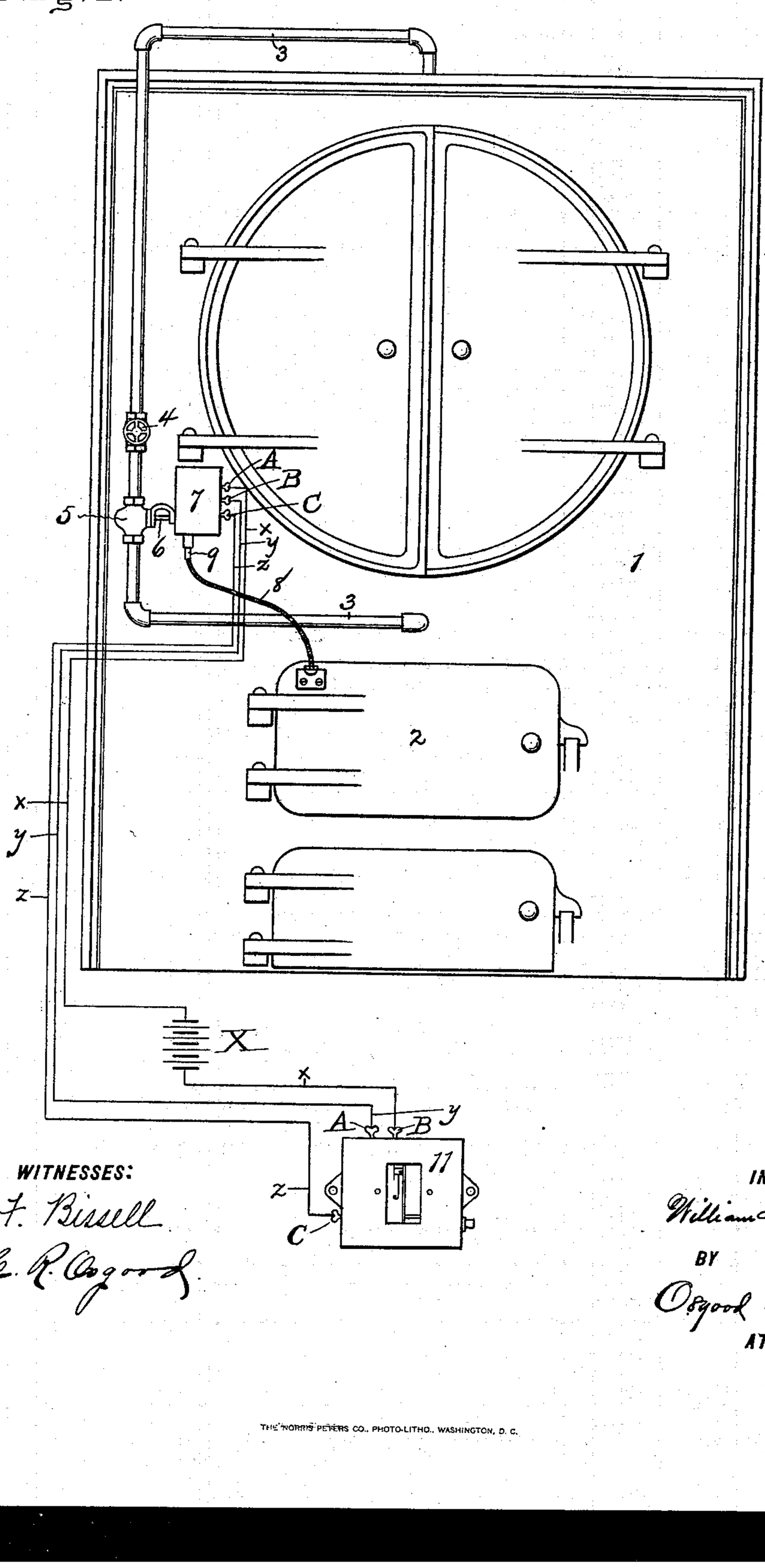

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Fig. 2

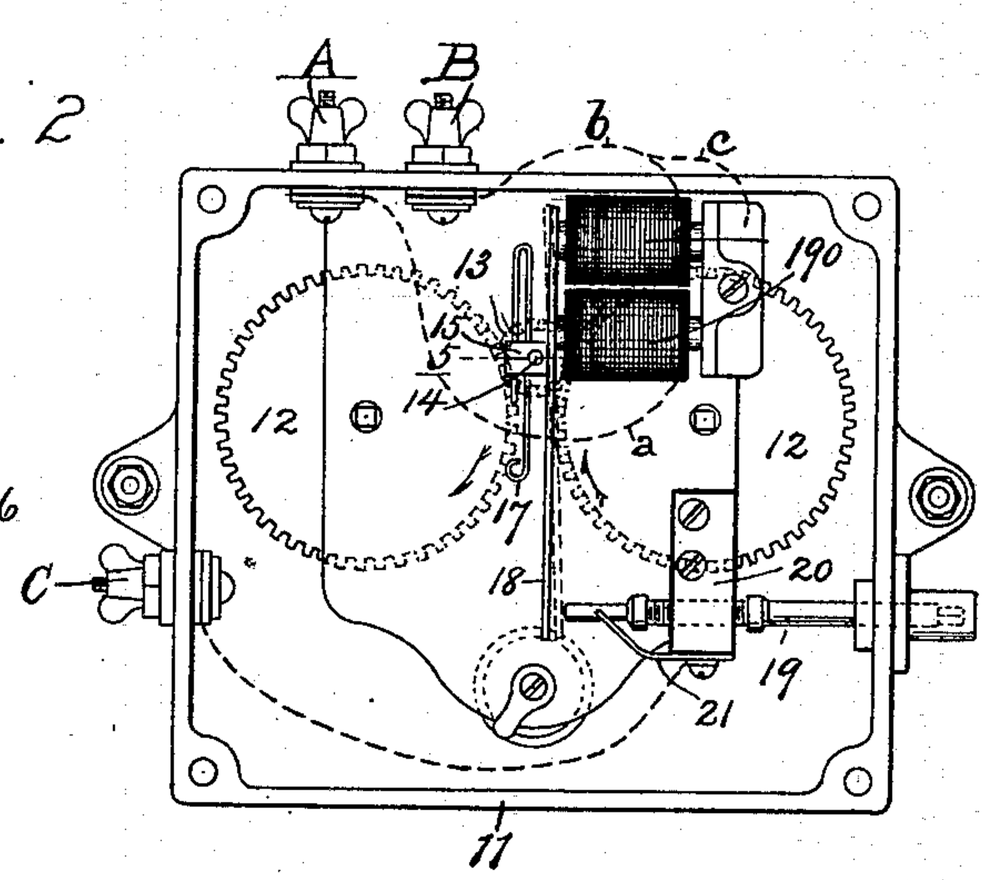


Fig. 5.

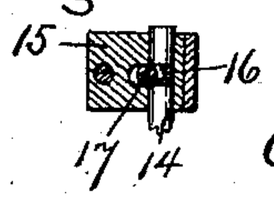


Fig. 4.

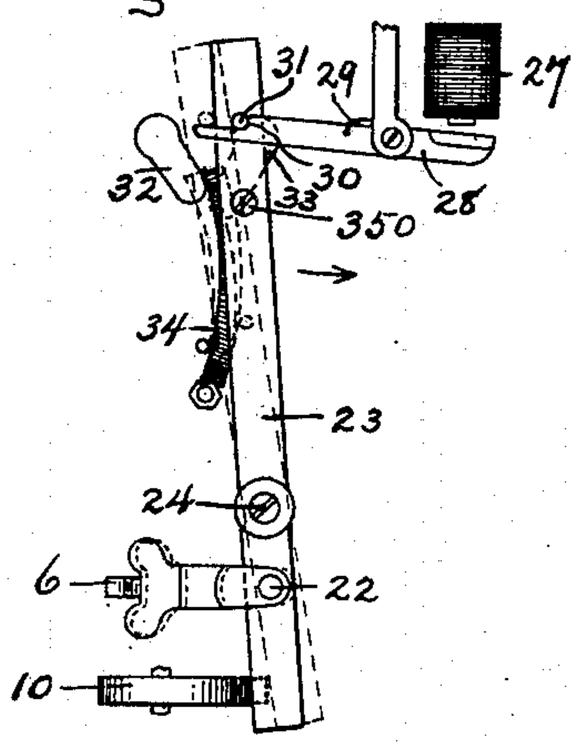
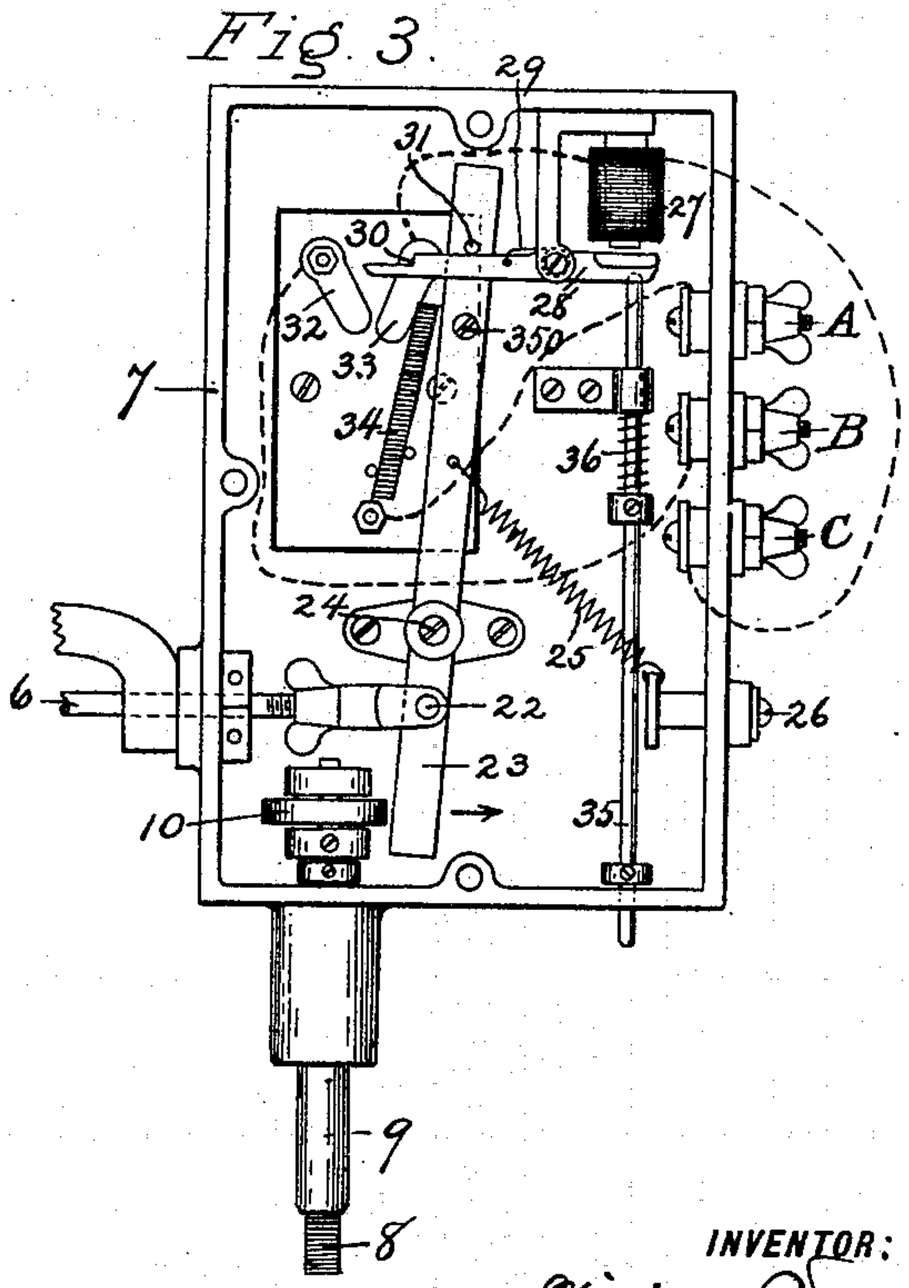


Fig. 3.



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UNITED STATES PATENT OFFICE.

WILLIAM L. DENIO, OF ROCHESTER, NEW YORK, ASSIGNOR TO THE DENIO SMOKE CONSUMER COMPANY, OF SAME PLACE.

SMOKE-CONSUMER.

SPECIFICATION forming part of Letters Patent No. 615,346, dated December 6, 1898.

Application filed May 11, 1898. Serial No. 680,424. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM L. DENIO, a citizen of the United States, and a resident of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Smoke-Consumers, of which the following is a specification.

This invention relates to smoke-consumers or devices whereby by means of a stream of oxidizing vapor or gas injected into the fire-space of a furnace the combustion of the gases or smoke is made more perfect.

The invention relates particularly to means for controlling or determining the length of time for which the injection of the vapor or gas shall continue.

The invention consists in the devices hereinafter described and claimed.

In the drawings, Figure 1 represents the front of a boiler-furnace having one of my devices applied thereto and showing also the regulating portion of the mechanism indicated as being at a suitably distant point from the furnace. Fig. 2 is a plan view of the regulator element in my device. Fig. 3 is a plan view of the valve-actuating device. Fig. 4 is a detailed view showing other positions of parts of the device shown in Fig. 3, and Fig. 5 is a cross-section on the line 5 of Fig. 2.

In the drawings, 1 is the front of a boiler-furnace.

2 is the fire-door, leading to the fire-space above the grate.

3 is a pipe leading from the steam-dome to a point in the boiler-front over the fire-door 2, whence the pipe 3 leads through the boiler-front and into the fire-space in a manner well known. In the pipe 3 is an ordinary valve 4, if so desired, and in said pipe is also a valve 5, which is preferably a balanced valve, which is provided with an extended valve-stem 6, leading into the box 7, which contains the valve-actuating mechanism.

To the fire-door 2 is attached one end of a flexible shaft 8, which is connected to a stem 9, leading into the box 7, and inside said box bearing an operating device, such as the cam 10. (Shown in Figs. 3 and 4.) This cam operates the valve-actuating mechanism in one direction whenever the furnace-door 2 is opened, thereby turning the shaft 8 and the cam 10. While the flexible shaft 8 is the preferred form of connection between the furnace-door and the valve-actuating mechanism, it is obvious that other devices adapted to transmit rotary movement from the fire-door 2 to the cam 10 may be used in its place.

The devices herein set forth are electrically operated, as hereinafter explained, and the box 7 bears binding-posts A B C, connected with the interior mechanism in said box and forming the terminals outside the box of three conductor-wires x, y, and z. In the conductor-wire x is a battery X. The wires x, y, and z run to binding-posts A, B, and C upon a box 11, containing the time-determining device. This box may be set in any suitable position, distant from or near to the furnace, according to the convenience of the user of the device.

The box 11 contains a double clock-movement having the gear-wheels 12 12, which are portions of identical clock mechanisms. The use of these duplicate clock mechanisms is for the purpose of security of operation of the device, so that if one of the clock mechanisms should break down the other would remain in operation. The two gear-wheels 12 12 mesh with a pinion 13 upon a stem 14. Upon this stem is a block 15, held thereon by friction, so that the block turns with the stem 14 when no resistance is interposed to the movement of the block; but the stem 14 turns in the block when resistance is interposed against the movement of the latter. In order to fasten the block 15 upon the stem 14, I employ the devices shown in Figs. 2 and 5. The stem has a groove 16, and in the groove rests a transverse spring-bar 17, which is attached to the block. The spring-bar 17 has slight movement in a slot in the block, as shown in Fig. 5, and rests in the groove 16 of the pin 14 with sufficient friction to be moved by the rotation of the pin 14, as above described. The block 15 bears a circuit-closer arm 18, which is capable of vibration upon the pin 14, as just described. One end of the arm 18 forms the armature of the electromagnet 190, and when said magnet is energized the arm 18 is drawn into the position shown in full lines in Fig. 2.

Connecting-wires *a b* run from the binding-posts A B of the box 11 to the coils of the electromagnet 190. Adjacent to the other end of the arm 18 is an adjustable contact device consisting of the rod 19, screw-threaded for a portion of its length and passing through an insulated block 20 within the box 11, so that when the rod 19 is turned its end may be moved to or from the arm 18. From the wire *b*, running to the electromagnet 190, extends a branch wire *c*, connecting with the clock frame or box 11, and from the insulated block 20 a connecting-bar 21 runs to and presses upon a suitable portion of the rod 19, and from the binding-post C of the box 11 a connecting-wire *d* runs to the connecting-bar 21.

The binding-posts in the boxes 7 and 11 are of course insulated from said boxes, and the connecting-wires running from said binding-posts within the boxes to different parts of the mechanism are shown in dotted lines in Figs. 2 and 3, but are of course ordinarily insulated and placed within the boxes in suitable positions, while for clearly showing the operation of the machine they are in the figures shown as running outside of the boxes. These connecting-wires are shown in dotted lines in the two figures mentioned.

Within the box 7 is the valve-actuating mechanism. The valve-stem 6 passes into the box and is pivoted at 22 to a lever 23, which latter is pivoted at 24 inside the case 7. An end of the lever projects into such a position that the turning of the cam 10 moves the lever and the valve-stem to open the valve 5 and permit the passage of steam through the pipe 3 into the fire-space of the furnace. The lever 23 is provided with a spring 25, attached to the casing of the box and adjustable for tension by means of a screw 26 for normally moving the lever in such a direction as to hold the valve closed. Fig. 3 shows the parts in the normal position of rest before the furnace-door 2 is opened. Within the casing 7 is an electromagnet 27, provided with an armature-arm 28, pivoted in a common manner. The armature-arm 28 involves a latch or retainer and is pressed by a spring 29, which tends to hold the armature away from the electromagnet 27 and to move the latching end of the arm 28 so that a notch or shoulder 30 upon said arm may engage a pin or projection 31 upon the lever 23. Within the box 7 are two insulated contact surfaces or points 32 and 33, and upon said block is also a movable contact-arm 34, which is preferably made of a coiled spring, as shown, attached at one end firmly to the block and free to move at the other end. A pin 35 upon the lever 23 is adapted, after a slight movement of the lever 23 from its normal position of rest has occurred, to come in contact with the arm or spring 34 and to move it successively into contact with the contact surfaces or points 32 and 33. The notch or shoulder 30 on the armature-arm 28 is in such a position that the pin 31 on the lever 23 will engage in said notch when the arm 34 makes contact with the surface or point 33; but the cam 10 is of such proportion that when it is turned by the opening of the furnace-door the lever is moved beyond the latching-point just mentioned and so far as to cause contact between the spring or arm 34 and the plate or surface 32. The binding-post A on the box 7 is connected with the spring or arm 34, and the binding-post C is connected through the electromagnet 27 with the contact plate or point 33. The binding-post B is connected with the surface or point 32.

As before stated, the battery X is interposed in the wire connecting the binding-post B on the box 11 with the binding-post A on the box 7. A rod 35 in the box 7 extends through the side of the box and to a point close to the armature-arm 28, so that by inward movement of the rod 35 the armature-arm 28 may be moved so as to release the latch from the pin 31 of the lever 23. A spring 36 normally holds the end of the rod 35 out of the range of movement of the arm 28.

The operation of the device is as follows: When it is desired to stoke the furnace, the fire-door 2 is opened, turning the flexible shaft 8 and the stem 9 from the position shown in Fig. 3, which turns the cam 10 into the position shown in dotted lines in Fig. 4. This operation of the cam moves the lever 23 in the direction of the arrow in Fig. 3 and into the position shown in dotted lines in Fig. 4, thus opening the valve. In this extreme position of the lever 23 the arm 34 makes contact with the plate or point 32, and the current from the battery X or from such other source of electrical energy as may be used in place of the battery is passed through the electromagnets 190 190 in the box 11, attracting the arm 18 and moving it into the position shown in full lines in Fig. 2, thus breaking contact between the end of the rod 19 and said arm 18. The clock-movements run continuously in the direction shown by the arrows in Fig. 2, and on account of the frictional connection of the arm 18 with the pinion-stem 14 the arm 18 will immediately begin to approach the rod 19 as soon as the current through the magnets 190 is broken. The position of the lever 23 which creates the electrical connection and the circuit just mentioned is retained so long as the furnace-door is open; but as soon as the furnace-door is closed or moves from the position which sets the cam 10 to the position for holding the lever 23 in its extreme position the lever under the action of the spring 25 moves back in the direction of the arrow in Fig. 4, so that the pin 31 drops against the shoulder 30 of the arm 28 and is held in this position. This movement of the lever 23 breaks the connection between the spring 34 and plate 32, but makes connection between the spring 34 and the plate 33, and so long as the lever 23 is latched this electrical connection is sustained and directs the battery-current through the

electromagnet 27; but the circuit for this purpose is interrupted until the arm 18 in the box 11 comes in contact with the end of the rod 19 and permits a current to pass from the binding-post B of the box 11 through the connection *b*, branch connection *c*, clock-frame, bar 21, pinion 14, arm 18, rod 19, bar 21, connection *d*, binding-post C, circuit-wire *z*, binding-post C on box 7, electromagnet 27, plate 33, arm 34, binding-post A, wire *x*, and the battery X. This set of connections attracts the armature-arm 28 and moves the retainer or latch so as to disengage from the pin 31 on the lever 23, permitting the lever to be moved by the spring 25 and to move the valve-stem 6 to close the valve and breaking the connection between the arm or spring 34 with the plate or point 33, thus disconnecting the battery. While the current is passing through the armatures 190 the pinion-stem 114 continues to revolve in the block 15; but as soon as the magnets 190 are deënergized the arm 18 begins to move toward the end of the rod 19 under the action of the clock-movement, and the time which is required for making contact between the arm 18 and rod 19 is adjustable by setting the end of the rod 19 at a desired position from that of the arm 18, substantially as shown in the full lines in Fig. 2.

If at any time it is desired to close the valve independently of the time-movement, the rod 35 is pushed inward and the lever is unlatched, which allows the valve to be closed by the action of the spring 25. The arrangement of the spring 17 in the block 15 is advantageous, because the tension or pressure of the spring upon the stem 14 can be changed and adjusted as desired.

The results of the operations above described are as follows: Upon opening the furnace-door the valve 5 is opened, permitting a current of steam to flow into the fire-space during the operation of stoking and to provide a sufficient quantity of oxygen to burn all the smoky products of combustion in the furnace. After the stoking is finished the door is closed; but the current of steam continues for such a predetermined length of time as is necessary for the arm 18 to make contact with the rod 19, whereupon the valve immediately closes and the current of steam is shut off.

What I claim is—

1. The combination with a furnace, of an injection-pipe into the fire-space thereof, a valve in said pipe, a valve-actuating mechanism adapted to hold said valve normally closed, an operating device for opening said valve by moving said valve-operating mechanism from its normal position, a latch for said valve-actuating mechanism adapted to hold said valve open, a source of electrical energy, an electrical circuit and circuit-closer therein, time devices for operating said circuit-closer to close said circuit after a predetermined interval and electrical devices for releasing said latch when the circuit is closed by the circuit-closer.

2. The combination with a furnace, of an injection-pipe into the fire-space thereof, a valve in said pipe, a valve-actuating mechanism adapted to hold said valve normally closed, an operating device for opening said valve by moving said valve-operating mechanism from its normal position, a latch for said valve-actuating mechanism adapted to hold said valve open, a source of electrical energy, an electrical circuit and circuit-closer therein, time devices for operating said circuit-closer to close said circuit after a predetermined interval, electrical devices for releasing said latch when the circuit is closed by the circuit-closer, a second electrical circuit comprising a circuit-closer operating by said valve-actuating mechanism, and electrical devices in said second circuit for resetting said first circuit-closer when the circuit is closed by said second circuit-closer.

3. The combination with a furnace, of an injection-pipe into the fire-space thereof, a valve in said pipe, a valve-actuating mechanism comprising a spring tending to close said valve, an operating device for opening said valve by moving said valve-operating mechanism against the tension of the spring, a latch for said valve-actuating mechanism adapted to hold said valve open against the tension of the spring, a source of electrical energy, an electrical circuit and circuit-closer therein, a time device for operating said circuit-closer to close the circuit after a predetermined interval, and electrical devices for releasing said latch when said circuit is closed by said circuit-closer.

4. The combination with a furnace, of an injection-pipe into the fire-space thereof, a valve in said pipe, a valve-actuating mechanism comprising a spring tending to close said valve, an operating device for opening said valve by moving said valve-operating mechanism against the tension of the spring, a latch for said valve-actuating mechanism adapted to hold said valve open against the tension of the spring, a source of electrical energy, an electrical circuit and circuit-closer therein, a time device for operating said circuit-closer to close the circuit after a predetermined interval, an electrical device for releasing said latch when said circuit is closed by said circuit-closer, a second electrical circuit comprising a second circuit-closer operated by said valve-actuating mechanism, and electrical devices in said second circuit for resetting said first circuit-closer when said second circuit is closed by said circuit-closer.

5. The combination with the furnace, of an injection-pipe into the fire-space thereof, a valve in said pipe, a valve-actuating lever for operating said valve, means tending to move said lever to hold said valve closed, means for operating said lever to open said valve, a latch for retaining said lever to hold said valve open, a source of electrical energy,

an electrical circuit and circuit-closer therein, a time device for operating said circuit-closer to close said circuit after a predetermined interval, and electrical devices for releasing said latch when said circuit is closed by said circuit-closer.

6. The combination with a furnace, of an injection-pipe into the fire-space thereof, a valve in said pipe, a valve-actuating lever for operating said valve, means tending to move said lever to hold said valve closed, means for operating said lever to open said valve, a latch for retaining said lever to hold said valve open, a source of electrical energy, an electrical circuit and circuit-closer therein, a time device for operating said circuit-closer to close said circuit after a predetermined interval, electrical devices for releasing said latch when said circuit is closed by said circuit-closer, a second electrical circuit comprising a second circuit-closer operated by said lever, and electrical devices in said second circuit for resetting said first circuit-closer when said second circuit is closed by said second circuit-closer.

7. The combination with a furnace, of an injection-pipe into the fire-space thereof, a valve in said pipe, a valve-actuating mechanism adapted to hold said valve normally closed, an operating device for opening said valve by moving said valve-operating mechanism from its normal position, a latch for said valve-actuating mechanism adapted to hold said valve open, a source of electrical energy, an electrical circuit and circuit-closer therein, a time device for operating said circuit-closer to close said circuit after a predetermined interval, electrical devices for releasing said latch when the circuit is closed by the circuit-closer, and a connection between said operating device and the fire-door of the furnace for opening said valve when said door is opened.

8. The combination with a furnace, of an injection-pipe into the fire-space thereof, a valve in said pipe, a valve-actuating mechanism adapted to hold said valve normally closed, an operating device for opening said valve by moving said valve-operating mechanism from its normal position, a latch for said valve-actuating mechanism adapted to hold said valve open, a source of electrical energy, an electrical circuit and circuit-closer therein, a time device for operating said circuit-closer to close said circuit after a predetermined interval, electrical devices for releasing said latch when the circuit is closed by the circuit-closer, a second electrical circuit comprising a circuit-closer operated by said valve-actuating mechanism, electrical devices in said second circuit for resetting said first circuit-closer when the circuit is closed by said second circuit-closer, and a connection between said operating device and the fire-door of the furnace for opening said valve when said door is opened.

WILLIAM L. DENIO.

Witnesses:
S. P. MOORE,
FRANCES BISSELL.