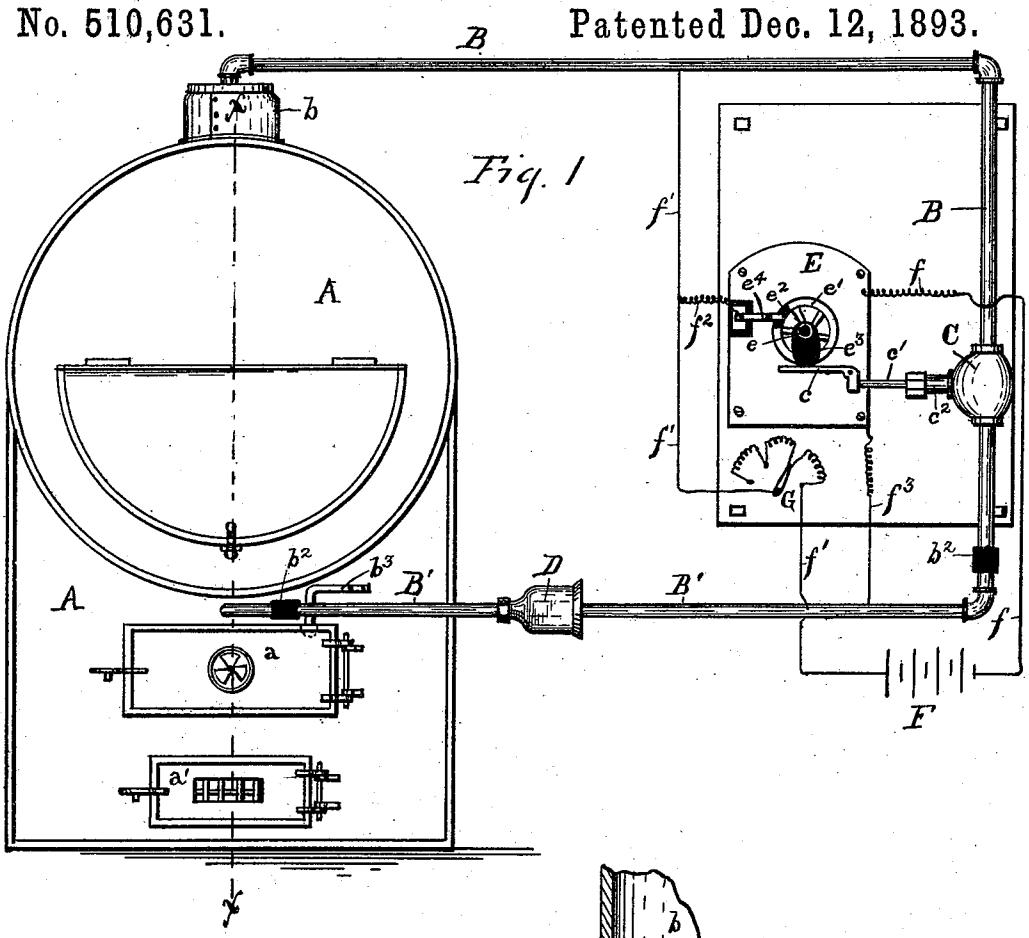
(No Model.)

W. L. DENIO.

SMOKE CONSUMING FURNACE.

No. 510,631. Patented Dec. 12, 1893.



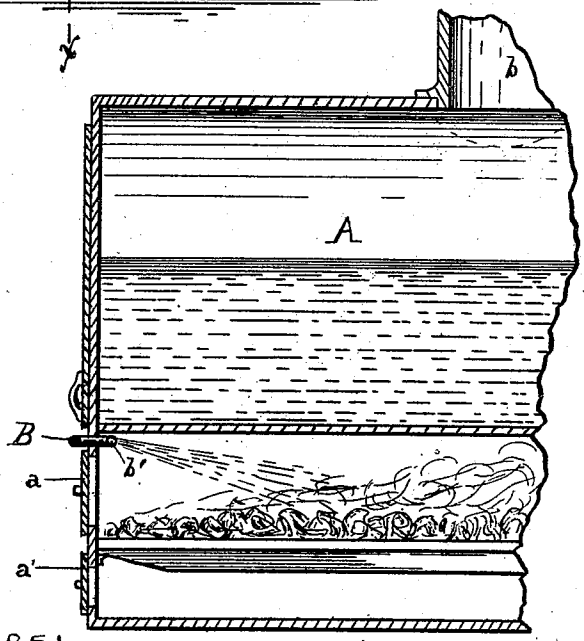


Fig. 2

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WILLIAM L. DENIO, OF ROCHESTER, NEW YORK.

SMOKE-CONSUMING FURNACE.

SPECIFICATION forming part of Letters Patent No. 510,631, dated December 12, 1893.

Application filed March 6, 1893. Serial No. 464,887. (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 the city of Rochester, in the county of Monroe, New York, have invented certain new and useful Improvements in Smoke-Consuming Furnaces, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1, is a front elevation of a steam boiler furnace showing my invention applied thereto. Fig. 2, is a partial, vertical, longitudinal section on the line x—x of Fig. 1.

My invention relates to that class of devices wherein steam or air, or mixed steam and air, are injected into the fire space of a steam boiler, at and after the time when the supply of fuel is thrown upon the grate for the purpose of temporarily increasing the supply of oxygen to the fuel in order to create a more rapid and perfect combustion of the gases and soot produced by the fuel at that time.

My invention consists in the devices hereinafter described and claimed.

In the drawings, A, represents a steam boiler having a stoking door a, and a draft door a'.

B B′, is a circuit of steam pipe leading, in the form shown, from the steam dome b through a valve C and a device D for injecting air and steam into the pipe B just before it returns to the furnace.

In the drawings, the injector D is shown for the sake of clearness, at a little distance from the furnace, but the injector may be placed at any suitable position in the circuit of the pipe. The pipe B enters the front wall of the furnace as shown in Fig. 2, and passes into the fire space, so that the mixed steam and air may be injected as shown in Fig. 2, through suitable nozzles or a perforated pipe b' to mingle with the products of combustion in the fire space. In the circuit of pipe are interposed two connections b^2 b^2, which are electrical insulators, whereby the pipe B′ between the insulators is electrically disconnected from the remainder of the circuit. The injector D may be placed between these insulators or without the same, as may be convenient for constructive purposes. A spring b^3 is attached to the front plate of the furnace, which, when the door a is opened, makes an electrical contact and connects with the pipe B′ between the insulators b^2 b^2, but when the door a closes, it presses the spring b^3 out of contact with the pipe B′.

An electrical motor E of any suitable form is placed in a position suitably adjacent to the valve C; this motor has a suitable rate of revolution for the purposes hereinafter described. Upon its main shaft e, is a wheel e', provided with an insulating spot e^2 and an insulated cam e^3; a suitable insulated contact spring e^4 presses upon the wheel e' and is electrically disconnected therefrom by the insulating spot e^2; a lever c suitably pivoted is operated by the cam e^3; the lever c presses upon the valve stem c' and serves to open and close the valve C. A battery F, or other suitable source of electrical energy, drives the motor E. A set of resistance coils G is introduced into the circuit passing through the motor, whereby the rate of revolution of the motor may be varied. The battery F has the following connections:—The connection f to the motor is constant from one pole of the battery; the other pole of the battery is connected by the wire f' to the circuit of pipe B B, outside of the portion between the insulators b^2 b^2; in this connection f' may be inserted into the resistance coils G, and from the connection f' the side connection f^2 runs to the contact spring e^4; the pipe B′, between the insulators b^2 b^2, is also connected as by the wire f^3, to the motor. The whole device is at rest as shown in Fig. 1, the contact spring e^4 resting upon the insulating spot e^2 and the spring b^3 out of contact with the pipe B′. The furnace door is opened and the furnace is thus electrically connected with the part of the pipe B′ between the insulators b^2 b^2. The current passes from the battery through the connection f into and through the motor; thence through the wire f^3 into the insulated part of the pipe B′; thence through the spring b^3 to the furnace; thence through the portion of the pipes outside of said insulated part, and thence through the wire f' to the battery. The motor E revolves and the contact spring e^4 passes off from the insulated spot e^2 on the wheel e'. As soon as the contact spring e^4 comes into contact with the uninsulated portion of the wheel e', a new set of connections is set up. The stoking of

the furnace having been finished the door *a* may be closed, breaking the connection between the spring b^3 and the pipe B. The current from the battery now passes into the motor through the wire *f;* thence through the shaft *e* into the wheel *e';* thence through the contact strip e^4 and the side connection f^2 into the connection *f'* and thence to the battery. The revolution of the motor will continue until the insulated spot e^2 breaks the connection between the wheel *e'* and the contact spring e^4, whereupon the motor will stop. In the revolution of the motor the cam e^3 operates the lever *c*, which operates the valve C. The cam is so set upon the shaft of the motor that when the motor is at rest, with the contact spring e^4 upon the insulated spot e^2, the valve is completely closed. The revolution of the motor begins to open the valve C as soon as the door *a* is opened, thereby admitting a jet of steam, or steam and air mixed, as may be desired, into the fire space and causing a more perfect oxidation of the products of combustion; the stoking is completed, the door is closed and the valve remains open until the motor E has caused one complete revolution of the cam e^3; at the end of said revolution of the cam, the valve is again closed. As before stated, the rate of revolution of the motor may be varied by resistance coils G. The valve C in the device shown in the drawings, must be provided with a spring within the packing box c^2, tending constantly to open the valve. The cam e^3 and the lever *c* operate against the force of the spring. The cam e^3 is circular or elliptical. The revolution of the motor will cause the cam to operate upon the lever *c*, and thereby to open the valve progressively from the point of complete closure of the valve to a maximum and from the maximum to complete closure again. By this means the jet of oxidizing vapor or gas is turned on slowly and the force and quantity of injection is increased to a maximum, and then decreased until the valve is closed. The result of this operation is, that the injected vapor or gas does not by its quantity or temperature tend to cause rapid contraction of the exposed portions of the boiler shell. Other devices known to me for the injection of vapor or gas into the combustion chamber of the furnace provide for an immediate injection in maximum quantity of the oxidizing vapor or gas and the tendency is to produce rapid contraction in the exposed portions of the boiler and to produce leakage thereof on account of the cooling effect. I obviate this difficulty by the means just described.

It is obvious that the motor E may be geared up or down in order to adjust the rate of its revolution to the desired time of injection of oxidizing vapor or gas into the fire space.

I do not limit myself to the particular forms of mechanism shown and described in this application, as my invention relates broadly to means of controlling the injection of oxidizing vapor into the fire space by electrical apparatus and connections.

What I claim is—

1. In a smoke consuming furnace, a pipe adapted to admit oxidizing vapor or gas into the fire space, a valve controlling the flow of vapor or gas in said pipe, a motor and cam operated by said motor to gradually open said valve to the maximum and then to gradually close the same, substantially as described.

2. In a smoke consuming furnace, a pipe adapted to admit oxidizing vapor or gas into the fire space, a valve controlling the flow of vapor or gas in said pipe, an electrical motor for operating said valve, and an electrical connection whereby the motor is set in operation by moving the furnace door, substantially as described.

3. In a smoke consuming furnace, a pipe adapted to admit oxidizing vapor or gas into the fire space, a valve controlling the flow of vapor or gas in said pipe, an electrical motor having a cam upon its shaft, a lever operated by said cam and operating said valve, a source of electrical energy, connections with the furnace door whereby the motor is set in operation by opening the door, connections whereby the motor is continued in operation when the door is closed and means for automatically stopping said motor substantially as described.

4. In a smoke consuming furnace, a circuit of pipe leading from the boiler into the fire space, a valve controlling the flow of steam in said pipe, an injector interposed in said circuit, an electrical motor for operating said valve, a source of electrical energy, connections with the furnace door whereby the motor is set in operation by opening the door, connections whereby the motor is continued in operation when the door is closed and means for automatically stopping said motor, substantially as described.

5. In a smoke consuming furnace, a circuit of pipe leading the steam from the boiler into the fire space, a steam and air injector interposed in said circuit, a valve controlling the flow of steam in said circuit, a source of electrical energy, an electrical motor for operating the said valve, an electrical connection adapted to be made when the door is opened, connections with said motor and said source of energy whereby the motor is started when the door is opened, independent connections whereby the motor is operated after the door is opened and means for breaking the electrical circuit when the motor has operated as predetermined, substantially as described.

6. In a smoke consuming furnace, a circuit of pipe leading the steam from the boiler into the fire space, a steam and air injector interposed in said circuit, a valve controlling the flow of said steam in said circuit, a source of electrical energy, an electrical motor provided with means for operating said valve, a wheel upon the shaft of said motor having an

insulating spot thereon, a contact piece for making connections with said wheel, an electrical connection adapted to be made when the furnace door is opened, connections with said source of energy through the door, connections whereby the motor is started in operation when the door connection is made and whereby said contact piece makes electrical contact with the said wheel, connections through said motor, said wheel and said contact piece whereby the motor continues in operation until the insulating spot breaks connection between said contact piece and said wheel, whereby the steam is injected into the fire space when the furnace door is opened and continues to be injected thereinto until the motor stops its revolution, substantially as described.

7. In a smoke consuming furnace, a circuit of pipe leading from the boiler into the fire-space, a valve controlling the flow of steam in said pipe, an injector interposed in said circuit, an electrical motor for operating said valve, a source of electrical energy, connections whereby the motor is set in operation by opening the furnace door, connections whereby the motor is continued in operation when the door is closed, means for automatically stopping said motor, and a series of electrical resistance coils adapted to be interposed into the circuit of the motor whereby the rate of operation of the motor may be varied, substantially as described.

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ASA W. RUSSELL.