(No Model.) 4 Sheets—Sheet 1.

W. C. WETMORE.

SMOKE CONSUMING FURNACE.

No. 575,537. Patented Jan. 19, 1897.

Fig. 4.

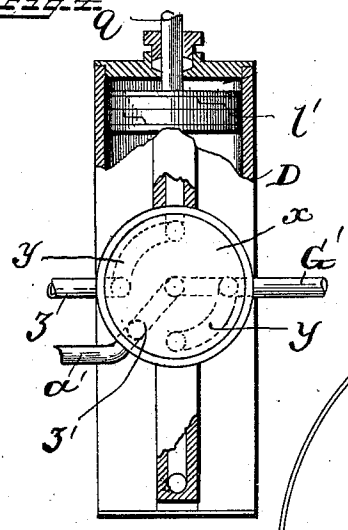

Fig. 1.

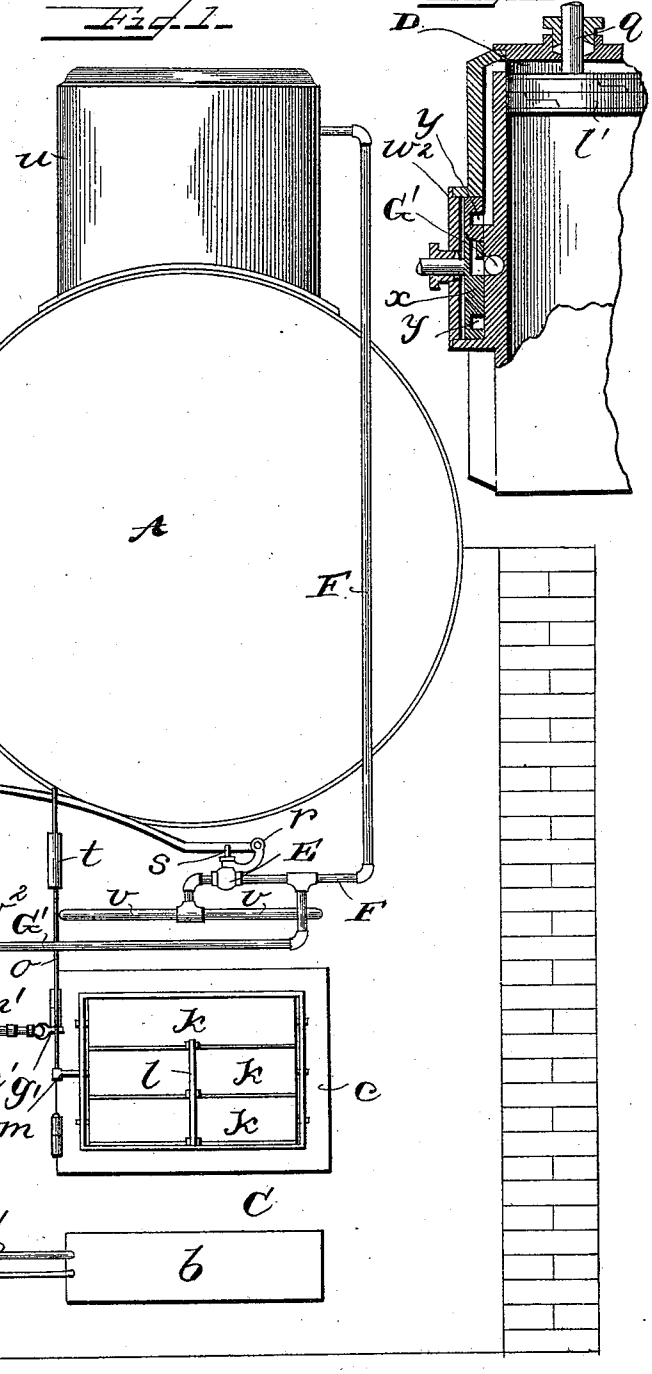

Fig. 5.

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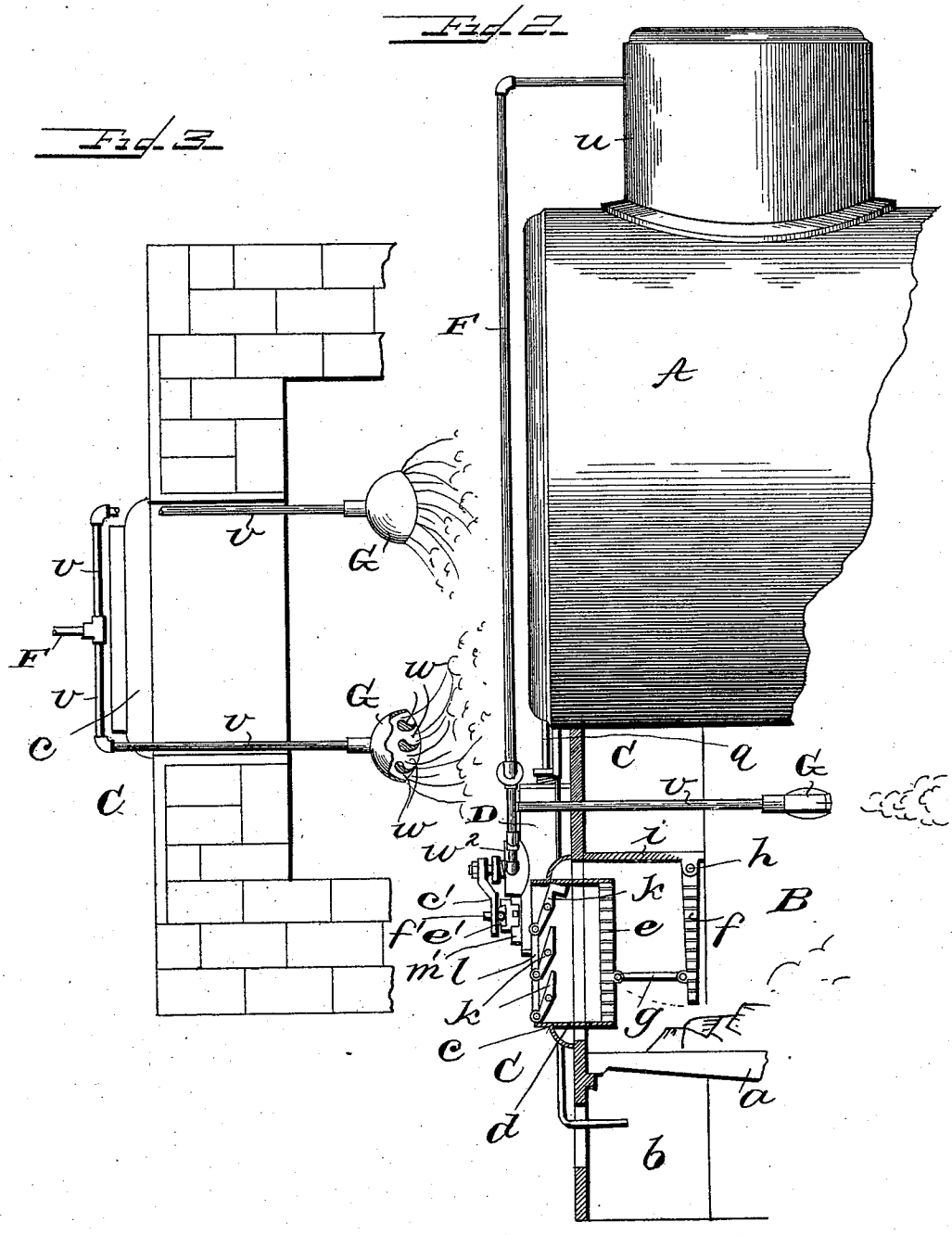
Fig. 2.

Fig. 3.



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SMOKE CONSUMING FURNACE.

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Fig 6.

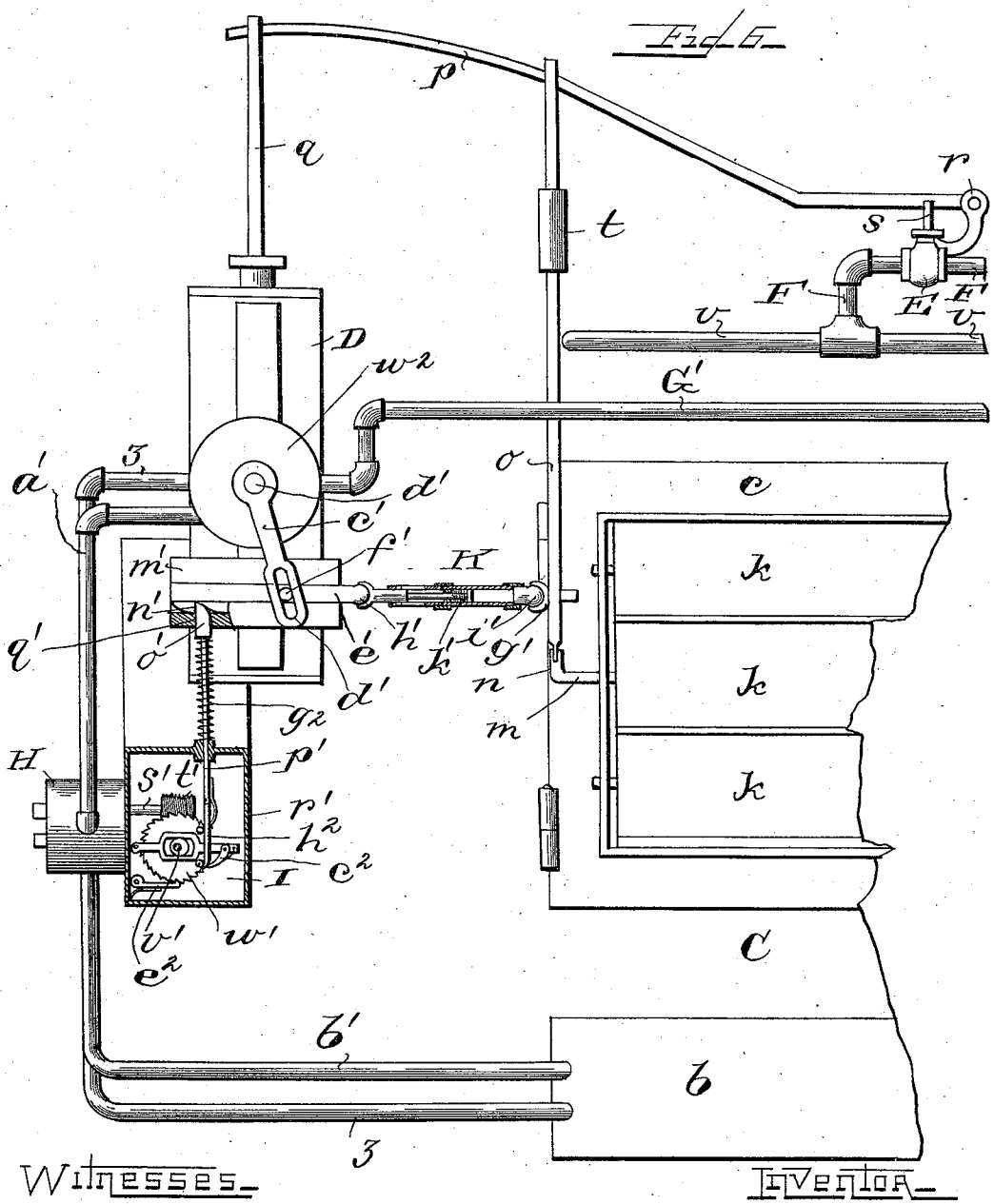

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Fig. 7.

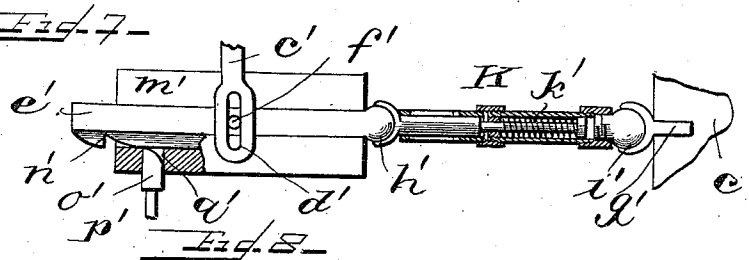


Fig. 8.

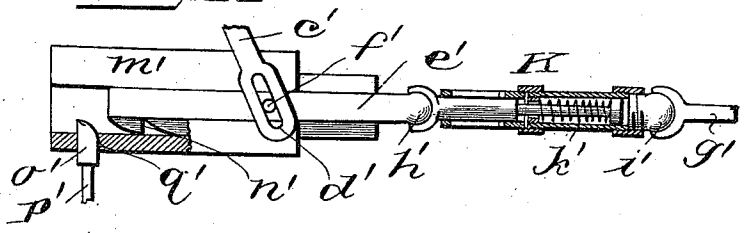


Fig. 9.

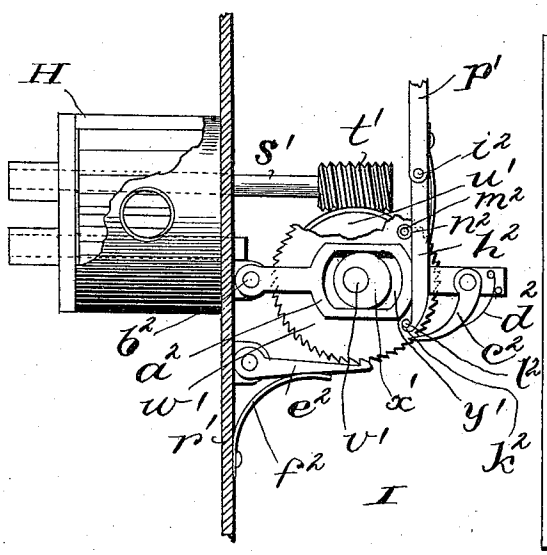
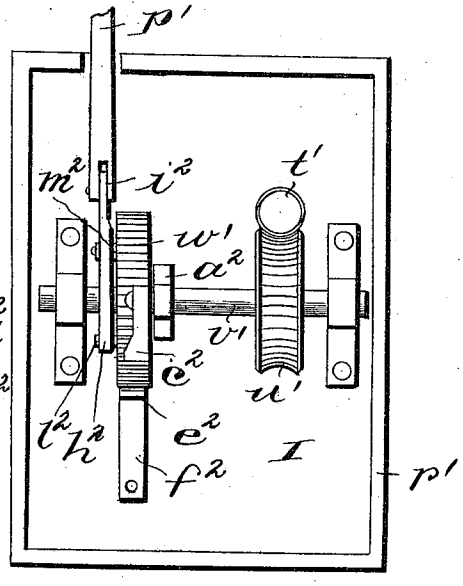


Fig. 10.



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UNITED STATES PATENT OFFICE.

WILLIAM CALKINS WETMORE, OF BUFFALO, NEW YORK.

SMOKE-CONSUMING FURNACE.

SPECIFICATION forming part of Letters Patent No. 575,537, dated January 19, 1897.

Application filed March 20, 1896. Renewed December 23, 1896. Serial No. 616,948. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM CALKINS WETMORE, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented certain new and useful Improvements in Smoke-Consuming Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My present invention relates to furnaces designed for use in connection with steam-boilers, has especial reference to means employed for consuming smoke arising from the fuel used, and consists in certain improvements in construction which will be fully disclosed in the following specification and claims.

In the accompanying drawings, which form part of this specification, Figure 1 represents a front elevation of a stationary steam-boiler provided with my smoke-consuming apparatus; Fig. 2, a vertical section of the same, showing the steam-boiler, the steam-spreader, and its supply-pipes in side elevation; Fig. 3, a horizontal section of the furnace above the steam-spreaders; Fig. 4, a side elevation, partly in section, on an enlarged scale, showing the reciprocating motor for controlling the supply of steam and air to the furnace; Fig. 5, a vertical section, partly in side elevation, of the same; Fig. 6, a front elevation, partly in section, on an enlarged scale, showing the mechanism for controlling the supply of steam and air to the furnace; Fig. 7, a side elevation, partly in section, showing the cross-head for operating the valve which controls the supply of steam to the motors and its extensible connection with the furnace-door, the cross-head being at the end of its inward stroke; Fig. 8, a like view of the same, the cross-head being at the end of its outward stroke; Fig. 9, a side view of the automatic gear for shutting off the supply of steam and air to the furnace, the side of the casing or chest being removed; and Fig. 10, a rear view of the same with the casing removed.

Reference being had to the drawings and the letters thereon, A indicates a steam-boiler, which may be of any approved form; B, the furnace, provided with suitable grate-bars *a*, upon which the fuel rests, and an ash-pit *b*.

C indicates the front of the furnace, having a door *c*, provided with a deep flange or neck *d*, at the inner end of which is a fixed vertical grate *e* to separate the air admitted into numerous streams, and to said fixed grate is attached a horizontally-movable grate *f* by a rod *g*, pivotally connected to both of said grates, and the grate *f* is pivotally attached at its upper end, as at *h*, to a horizontal extension *i* of the front C, and in its normal position is in a vertical plane parallel to the grate *e*, and extends into the furnace a sufficient distance to become highly heated by the fuel to superheat the air, which receives its initial heat in the neck of the furnace-door in its passage through the grate *e*.

In the front end of the door and extending transversely across the same are a series of slats or shutters *k*, (the number of which may be varied according to the size of the door,) pivotally supported in the door at their ends to swing horizontally, and are connected by a rod *l* to operate synchronously, and from one of the shutters extends an arm *m*, having a crank *n* at its outer end, which is connected to a rod *o*, whose opposite end engages a lever *p*, one end of which is connected to the piston-rod *g* of the reciprocating motor D and the opposite end to a bracket *r* adjacent to the steam-supply valve E, the stem *s* of which engages the lever *p* and is closed thereby. The rod *o* may be provided with an enlarged section *t* to receive a spiral spring (not shown) to cushion the motion of the rod in operating the shutters *k*.

The shutters *k* are so adjusted in the door of the furnace that induction of air is never entirely cut off, as shown in Fig. 2, but the supply of air may be greatly increased when necessary to perfect the combination of the smoke and gases arising from fresh fuel supplied to the furnace.

F indicates a steam-supply pipe leading from the steam-dome *u* of the boiler to conduct dry steam to the furnace through valve E and branch pipes *v v*, which enter the furnace B through the front C above the furnace-door and are provided with nozzles or spreaders G, in which are passages *w*, having

their walls curved, as shown in Fig. 3, to impart to the steam a gyratory or whirling motion as it is emitted from the nozzles, which causes the superheated steam to spread in the furnace and mingle with the smoke and gases arising from the fuel and with the air supplied through the furnace-door and consume the smoke by converting these heavy products of combustion into flame, in which form they pass through the fire-tubes of the boiler.

To the pipe F is connected a pipe G', which supplies steam to a valve-chest w^2 on the cylinder of the motor D, and said chest is provided with a disk valve x, having ports y y, which control the supply of steam to and exhaust the steam from the motor D, the exhaust-steam being conducted to the ash-pit b of the furnace through pipe z, and with a port z', which controls the supply of steam to the rotary motor H, which operates the time-gear I, through pipe a', and the exhaust-steam from the rotary motor is also conducted to the ash-pit of the furnace through pipe b'. The valve x has axial motion imparted to it by an arm c', connected at one end to the shaft d', which extends through the chest w, the opposite end of said arm c' being slotted at d' and connected to a reciprocating cross-head e' by a pin f', projecting from the cross-head, which is attached by a telescopic connection K to a lug g' on the door c of the furnace, as shown in Figs. 1, 6, 7, and 8, so that in opening the door c the valve x is turned on its axis and steam admitted to the lower side of the piston l', the piston raised, and the valve E and the shutters k opened, and said telescopic connection is provided at each end with a ball-and-socket joint h' i' and with a spring k', which by its tension draws the cross-head e' outward when released by the time mechanism I, rotates the valve x by its connection with arm c', supplies steam to the upper side of the piston l' of the motor D, and shuts off the supply of steam to the nozzles G and the supply of air by closing the shutters k in the furnace-door. The cross-head e' is supported in a seat m' and is provided on its under side with a notch n', with which the head o' of a rod p' engages through a slot g' in the seat m'.

The time-gear I is inclosed in a casing r', and on the outer end of the shaft s' of the rotary motor H is a worm-gear t', which engages a worm gear-wheel u', mounted upon a shaft v', provided with a ratchet-wheel w', attached loosely to the shaft and adjacent to the ratchet-wheel, but secured to the shaft v' is an eccentric cam x', which engages the slot y' in a yoke a^2, that is pivotally connected at its inner end at b^2 to the casing of the time-gear, and in the revolution of the cam x' a forward-and-backward motion is imparted to the yoke a^2, which is provided at its forward end with a pawl c^2, which engages the teeth of the ratchet-wheel w' and revolves said wheel, the pawl being held in engagement with the teeth of the wheel by a spring d^2 and the wheel revolved one notch during each revolution of the worm gear-wheel u'. The ratchet-wheel is held in position by a pawl e^2 on the under side of the wheel, the pawl being held in engagement with the teeth of the wheel by spring f^2.

The rod p' is provided with a spring g^2 between the head o' and the upper side of the casing r' to hold the head o' in engagement with the notch n' in the cross-head e' until released by the time-gear, and at the lower end of the rod p' is a pawl h^2, pivotally connected to said rod at i^2 and provided at its lower end with a hook k^2, which engages a stud or pin l^2 on one side of the ratchet-wheel w' and held in engagement with the pin l^2 until in the revolution of the ratchet-wheel the pin m^2, having a roller n^2 thereon, engages the pawl h^2 and disengages the hook k^2 from the pin l^2 when the wheel w' in its revolution has by the pin l^2 drawn the rod p' and its head o' downward and out of engagement with the slot n' in the cross-head e'. The cross-head having been released from the time-gear the spring k' in the telescopic connection K draws the cross-head forward, shifts the valve x, admits steam to the upper side of the piston l', and simultaneously cuts off steam to the motor H, which stops the motion of the time-gear, and the downward motion of the piston l' simultaneously closes valve E and shutters k, thus shutting off steam and reducing the supply of air to the normal quantity to support combustion.

The steam is superheated in the branches v and nozzles G before it is discharged by the heat of the furnace, and by the time the steam and air admitted to the furnace have converted the smoke into a combustible gas and the smoke has been consumed the supply of steam and air is automatically cut off, and when a fresh supply of fuel is necessary to be charged into the furnace the opening of furnace-door again automatically turns on the supply of steam and air to the furnace.

When the door of the furnace is opened to charge fresh fuel thereto, the grate f is drawn outward, assumes a horizontal position, and clears the passage for the introduction of the fuel, and as the door is closed the grate again assumes its vertical and normal position and comminutes the air and superheats it in its passage through the spaces in the grate.

Having thus fully described my invention, what I claim is—

1. In a boiler-furnace, a nozzle suspended within and above the fuel of the furnace and a steam-supply valve, in combination with a fluid-pressure-operated motor for opening and closing said valve, means for controlling said motor connected to the furnace-door and pivoted shutters in said door operated in both directions by said motor.

2. In a boiler-furnace, means for supplying steam above the door of the furnace and pivoted shutters in the door for supplying air

to the furnace, in combination with a fluid-pressure-operated motor and a connection with the furnace-door and the valve of said motor for automatically controlling the supply of steam and air to said furnace.

3. In a boiler-furnace, means for supplying steam and means for supplying air to the furnace, in combination with a fluid-pressure-operated motor, a steam-operated time mechanism and a connection with the furnace-door for automatically controlling the supply of steam and air to the furnace and steam to the motor operating the time mechanism.

4. In a boiler-furnace, means for supplying steam and means for supplying air to the furnace, in combination with a motor for operating said means and a telescopic connection containing a spring attached to the furnace-door and to the valve controlling said motor.

5. In a boiler-furnace, a door provided with pivoted shutters and a grate, in combination with a superheating-grate adjacent and connected to the door.

6. In a boiler-furnace, a door provided with pivoted shutters and a grate through which air is admitted to the furnace, in combination with a grate in a plane parallel to the grate in the door, pivotally supported above the door and pivotally connected thereto.

7. In a boiler-furnace, a door provided with pivoted shutters and a motor for operating said shutters, in combination with a valve, a cross-head connected to the valve and means for connecting the cross-head to the furnace-door.

8. In a boiler-furnace, means for supplying steam and air to the furnace, a motor for operating said means and an extensible connection between the valve of the motor and the furnace-door, in combination with a time mechanism comprising a motor, worm-gear, a ratchet-wheel and pawls.

9. In a boiler-furnace, means for supplying steam and air to the furnace, a motor for operating said means and an extensible connection between the valve-operating mechanism of the motor and the furnace-door, said connection being provided with an inclosed coiled spring and ball-and-socket joints in combination with a steam-operated time mechanism to control the means for shutting off the steam and air to the furnace.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM CALKINS WETMORE.

Witnesses:
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JAC. P. JUNG.