(No Model.) 2 Sheets—Sheet 1.

W. E. NAGEBORN.

AUTOMATIC DRAFT REGULATING MECHANISM.

No. 564,935. Patented July 28, 1896.

Fig. 1.

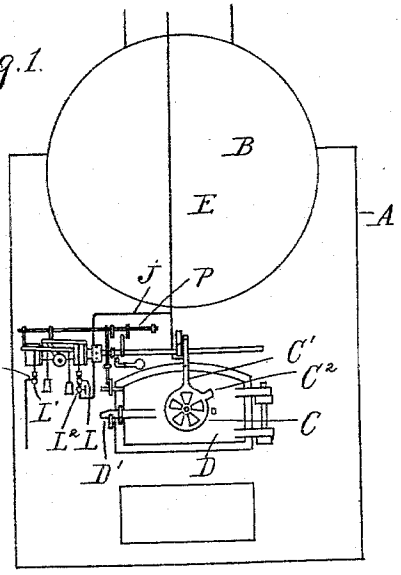


Fig. 9.

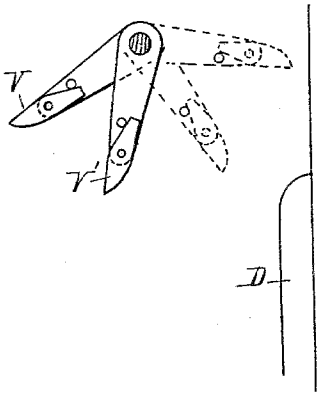


Fig. 7.

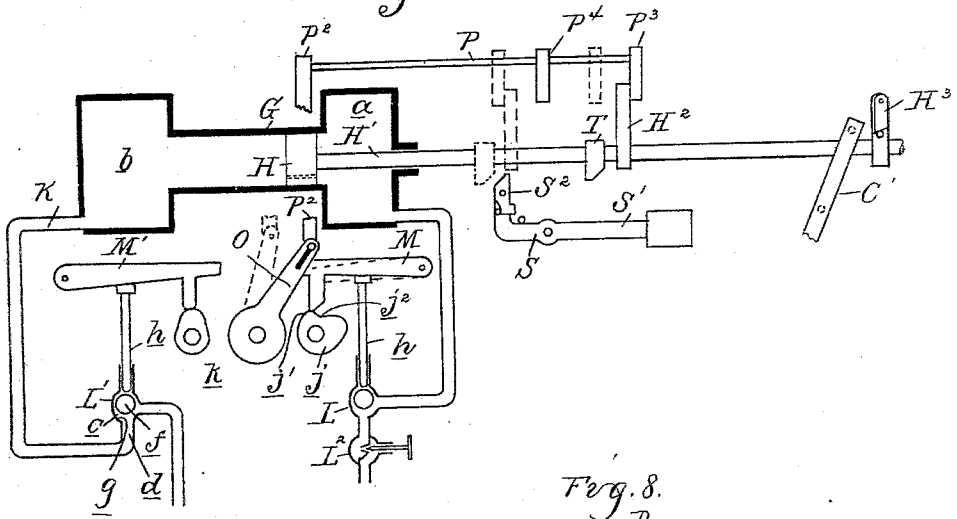
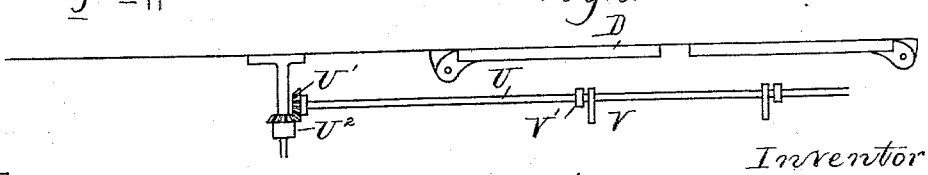


Fig. 8.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

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AUTOMATIC DRAFT REGULATING MECHANISM.

No. 564,935. Patented July 28, 1896.

Fig. 2.

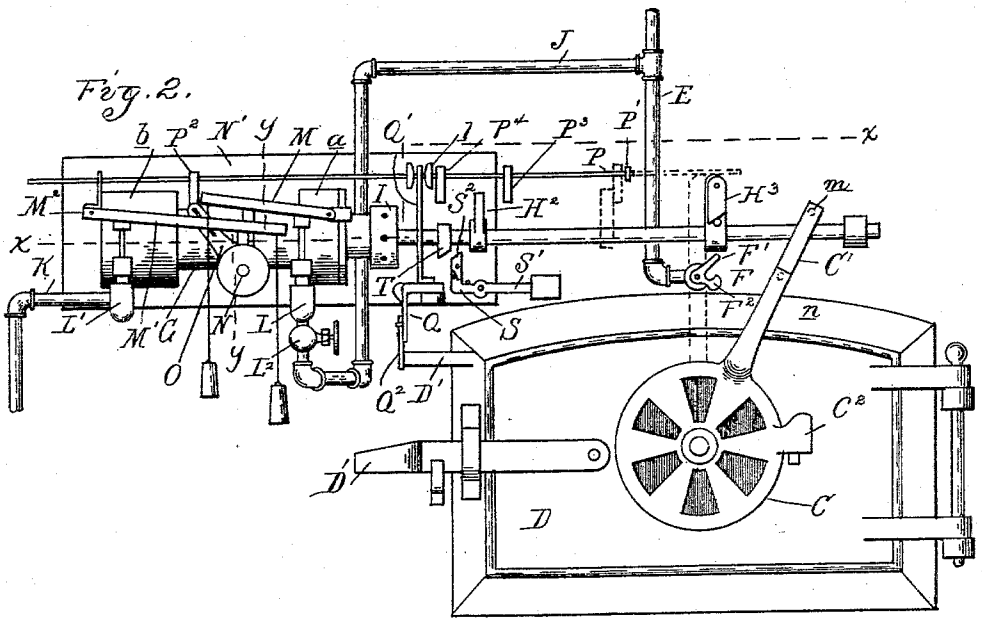


Fig. 3.

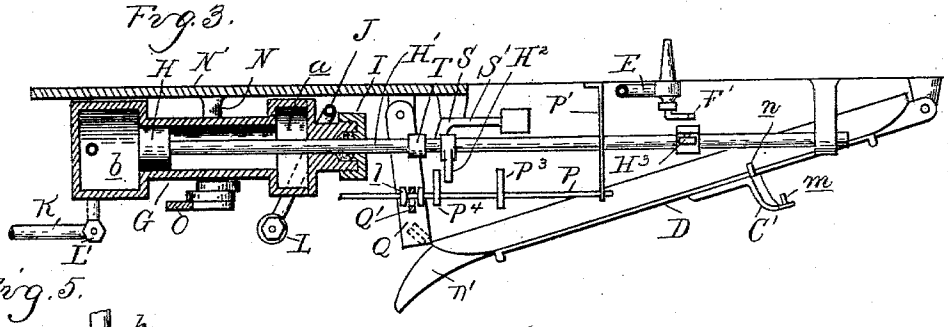


Fig. 5.

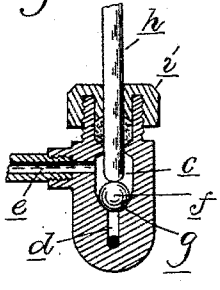


Fig. 4

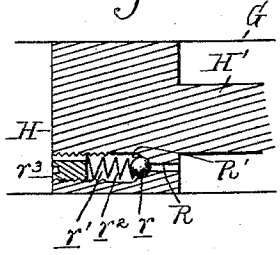
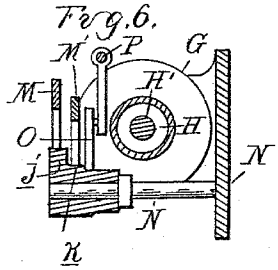


Fig. 6.



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UNITED STATES PATENT OFFICE.

WILHELM E. NAGEBORN, OF DETROIT, MICHIGAN, ASSIGNOR TO THE NATIONAL SMOKE PREVENTER COMPANY, OF SAME PLACE.

AUTOMATIC DRAFT-REGULATING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 564,935, dated July 28, 1896.

Application filed April 7, 1896. Serial No. 586,529. (No model.)

To all whom it may concern:

Be it known that I, WILHELM E. NAGEBORN, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Automatic Draft-Regulating Mechanism, of which the following is a specification, reference being had therein to the accompanying drawings.

It is the object of my invention to prevent imperfect combustion and the consequent formation of smoke in furnaces upon the introduction of fresh fuel therein by providing means for automatically increasing the draft at such times and cutting it off again after the lapse of a definite time interval, thereby consuming the excess of gases first generated without wasting the fuel.

The invention consists in the peculiar construction of the motor employed for automatically closing the draft-controlling devices, which is adapted to be operated by the cumulative pressure of steam (or other elastic fluid) admitted thereto.

The invention further consists in the means employed for controlling the operation of said motor, so as to allow the lapse of a definite interval of time after the introduction of the fuel into the furnace before the motor will operate to close the draft, and, further, in the peculiar construction, arrangement, and combination of parts, all as more fully hereinafter described and claimed.

In the drawings, Figure 1 is a diagram front elevation of a furnace to which my invention is applied. Fig. 2 is an enlarged view similar to Fig. 1. Fig. 3 is a longitudinal section on line x x, Fig. 2. Fig. 4 is an enlarged longitudinal section through the piston. Fig. 5 is a central section through one of the valves. Fig. 6 is a vertical cross-section on line y y, Fig. 2. Fig. 7 is a diagram illustrating the operation of the device. Figs. 8 and 9 are respectively a diagram plan and an end elevation of a modification of my device.

A is the furnace of a steam-generator, and B is the boiler.

C is an air-inlet damper to the furnace, which may be arranged in any suitable place to admit air above the fuel, preferably in the furnace-door D, as shown in the drawings.

E is a pipe for the introduction of steam into the furnace above the fire, and F is a controlling-valve. This pipe and valve, together with the damper C, constitute what I shall call "draft devices," which are adapted to be opened so as to increase the draft whenever fresh fuel is introduced into the furnace. I preferably accomplish this by so constructing my apparatus that the opening of the furnace-door will also open or throw on the draft, and the closing of the door will throw into operation a motor device, which after a certain lapse of time will close the draft device again, as will be more fully hereinafter described. It is not necessary, however, that the furnace-door be used for the actuating device, as other devices, such as a movable platform in front of the furnace on which the fireman is obliged to step in throwing in the fuel, would answer the purpose equally well.

The motor for closing the draft devices is preferably of the following construction:

G is a cylinder, preferably provided at each end with the enlarged chambers a and b.

H is a piston within the cylinder, having the rod H′ extending out through a stuffing-box I at one end of the cylinder.

J is a steam-inlet pipe connected with the chamber a of the cylinder, and K is an exhaust-pipe connected with the chamber b.

L and L′ are valves in the pipe J and K, respectively, which are preferably constructed as shown in Fig. 5, in which c is a central chamber. d is an inlet-port thereto. e is an outlet-port. f is a ball-valve. g is a seat for said valve. h is a stem passing out through the stuffing-box i and adapted to bear against the ball f to hold it to its seat.

M and M′ are weighted levers fulcrumed to suitable supports M^2 and resting upon the ends of the stems h of the valves L L′.

L^2 is another valve in the inlet-pipe J, adapted to be set so as to restrict the passage of steam therethrough.

N is a stud secured to the base-plate N′, to which the cylinder G is attached.

O is a rock-arm sleeved upon this stud N

and having secured thereto the cams j and k, adapted to lift the levers M M'.

P is a valve-operating rod slidingly secured in bearings P' and provided with an arm P^2, adapted to engage with a slotted bearing in the rock-arm O.

P^3 and P^4 are arms on the rod P, extending into the path of an arm H^2, carried by the piston-rod H'.

Q is an arm hinged to the base-plate N', having the extension Q' engaging with the rod P, between the collars l thereon, and the latch Q^2 extending into the path of a lug D' on the furnace-door.

The damper C is preferably in the form of a revolving radially-slotted damper in the furnace-door D, and is provided with an actuating-arm C' and a gravity-arm C^2, the latter tending to turn the damper to its open position, and the former extending into proximity to the piston-rod H'.

m is a pin at the end of the arm C', which extends into the path of a latch-arm H^3, carried by the piston-rod H'. The valve F has an operating-arm F' and a gravity-arm F^2, the latter tending to hold the valve in its open position.

n is a pin on the arm C', adapted in the movement of said arm to strike against the arm F' and turn it to close the valve.

R is a restricted port through the piston-head H.

R' is a check-valve, preferably formed by a ball r in the enlarged chamber r', and held normally to its seat by the spring r^2 bearing against the adjustable apertured plug r^3.

The piston-rod H' is provided with a delay device adapted to resist the initial movement of the piston until a certain steam-pressure is reached in the cylinder, and then to release the rod. This device, which I shall call the "resistance-latch," I preferably form as shown in Figs. 3 and 7 of the drawings, in which S is a lever fulcrumed to the plate N', having the gravity-arm S' and the latch S^2 at its free end extending into the path of an inclined lug T, carried by the rod H', the parts being so arranged that the gravity-arm S' will hold the latch S^2 in engagement with the lug T until a certain pressure is exerted against the piston, when the gravity-arm will be lifted and the piston allowed to make its stroke, the latch S^2 lifting in the return stroke of the piston to allow the lug T to pass.

The device being thus constructed it is intended to operate as follows: In the normal position of parts (shown in Fig. 1 of the drawings) the damper C and steam-inlet E are both closed, and the piston H is at the rear end of the cylinder G, as shown in Fig. 3. In this position the latch S^2 stands in the path of the inclined lug T on the piston H' and will prevent the movement of the piston until sufficient force is exerted to lift the gravity-arm S'. Whenever the furnace-door is opened to throw fresh fuel upon the fire, the gravity-arms C^2 and F^2 will open respectively the air-damper C and steam-inlet valve F. Upon closing the door again the lug D', striking against the latch Q^2 on the arm Q, will turn that arm, and through the extension Q' and collars l move the valve-rod P. This rod, through the engagement of the arm P^2 with the rock-arm O, will rock said arm and turn the cams j and k, which respectively operate the levers M and M' to open the steam-inlet valve L and close the exhaust-valve L'. Steam is thus admitted into the chamber a of the cylinder through the pipe J, and from the chamber a to the chamber b through the restricted port R in the piston H. The flow of the steam, however, is greatly retarded in passing through the valve L^2 and port R, so that an interval of time is required to raise the pressure within the cylinder on both sides of the piston to the requisite point. When this pressure is reached, the piston will be moved forward by the differential pressure exerted thereon, the whole of its rear face being exposed to the pressure of the steam in the chamber b, while the pressure area of the front face is reduced by the cross-section of the piston-rod H. As before stated, the resistance-latch prevents the initial movement of the piston until the pressure has reached the desired point, so that when the resistance is finally overcome the piston will make a quick forward stroke. In making this stroke the latch H^3 is carried beyond the arm C' of the damper, lifting to pass the pin m. At the same time the arm H^2 on the piston-rod will strike against the arm P^3 on the valve-rod, moving this rod forward, and through the medium of the arm P^2 and rock-arm O turning the cams j k, as shown in Fig. 7 of the drawings, in which the cams j k and the rock-arm O are represented diagrammatically as detached from each other. This movement of the cams j and k will open the exhaust-valve L' and close the steam-inlet valve L, which will allow the steam in the chamber b to exhaust, after which the steam still contained in the chamber a acting expansively will return the piston to its initial position. To render this return movement certain, however, I preferably hold the valve L open until the return of the piston is partly made, and to accomplish this I provide the cam j with a raised portion j', which opens the valve again after it has been closed by the depressed portion J^2 of the cam, as shown in Fig. 7. Upon the return movement of the piston the arm H^2 will strike the arm P^4 and move the valve-rod P so as to turn the rock-arm O into the position shown in dotted lines in Fig. 7, where the contacting-point of the weighted lever M will drop into the depressed portion j^2 of the cam and close the valve L. In making the return movement the latch H^3 will strike against the pin m on the arm C'

and turn the damper into its closed position, while at the same time the pin n on the arm C will strike the arm F′ and close the steam-inlet valve F. Thus the draft will be again shut off.

It will be observed that the time interval during which the draft devices are left open is that which is required for the pressure behind the piston H to raise to the required point, and this is determined by the degree to which the flow of steam is impeded.

It is immaterial as to whether the restricted passage is in the inlet-pipe J or the passage R through the piston; but in order that the degree of opening may be varied I preferably use the valve L^2 in the pipe J, which may be set to make the time of operation of any desired length. The restricted passage in the piston also serves to prevent too great an escape of steam in the return movement of the piston, while allowing the steam in the chamber a to slowly exhaust after the movement is made.

It will be also noticed that with the construction shown the time interval begins with the closing of the furnace-door and not with the opening thereof. Thus the draft devices are left open for a definite period of time after the fireman has completed the operation of throwing on the fuel.

In Figs. 8 and 9 of the drawings I show my device as applied to a furnace provided with two or more doors, and it is the object of this construction to start the operation of the motor by the closing of the last door, in whatever order these doors may be closed. In this construction in place of the sliding valve-rod P, I show a shaft U, connected by the bevel gear-wheel U′ with the sleeve U^2, carrying the cams. Upon the shaft U, opposite each of the fuel-doors of the furnace, is arranged a set of latch-arms V V′, the number of arms in each set being the same as the number of doors. These arms stand at such an angle to each other and in such relation to the furnace-doors that in the closing of any one of the doors it will strike against one of the arms V and turn the shaft through a partial revolution, bringing the second arms V′ in the paths of the doors. In closing the second door the shaft will be turned still farther, and so on until the last door will move it far enough to operate the valves. The operation is the same in whatever order the doors are closed.

I do not wish to limit myself to the particular form of connecting mechanism shown and described, as it is obvious that this may be modified in many ways, all of which are within the spirit of my invention.

What I claim as my invention is—

1. The combination with a furnace provided with draft devices, and automatic mechanism for opening the same whenever fuel is introduced into the furnace, of a motor for automatically closing said devices after the lapse of a time interval, adapted to operate by the cumulative pressure of steam or other elastic fluid admitted thereto, and means for admitting said fluid to said motor upon the operation of said automatic mechanism.

2. The combination with a furnace provided with draft devices adapted to be opened upon the opening of the furnace-door, of a motor for automatically closing said draft devices after the lapse of a time interval, comprising a cylinder, a piston therein, operatively connecting said draft devices, a restricted inlet-passage to said cylinder from a source of supply of steam, or other elastic fluid under pressure, and a valve controlling said passage adapted to be opened by the movement of said furnace-door.

3. The combination with a furnace provided with draft devices adapted to be opened by the opening of the furnace-door, of a motor for automatically closing said draft devices after the lapse of a time interval, comprising a cylinder, a piston therein, a restricted inlet-passage to said cylinder from a source of supply of steam or other elastic fluid under pressure, a valve controlling said passage adapted to be opened by the movement of the furnace-door, and a resistance-latch adapted to delay the initial movement of said piston.

4. The combination with a furnace provided with draft devices adapted to be opened by the opening of the furnace-door, of a motor for automatically closing said draft devices after the lapse of a time interval comprising a cylinder, a piston therein having unequal pressure areas on its opposite sides, a valve-controlled port for the admission of steam or other elastic fluid to said cylinder on the small-area side of the piston, a restricted port for said fluid to the opposite side of the piston, a resistance-latch for retarding the initial movement of the piston, and a valve-controlled exhaust-port connected to said cylinder on the large-area side of the piston adapted to be opened by the forward stroke thereof.

5. The combination with a furnace provided with two or more fuel-doors and draft devices adapted to be opened by the opening of said doors, of a motor adapted to close said draft devices after the lapse of a definite time interval from the closing of the last door.

6. The combination with a furnace provided with two or more fuel-doors and draft devices adapted to be opened by the opening of said doors, of a motor for closing said device after the lapse of a time interval operated by the cumulative pressure of steam or other elastic fluid and a valve-controlled port for admitting said fluid to said motor, adapted to be opened by the closing of the last door.

7. The combination with a furnace provided with two or more fuel-doors and draft devices adapted to be opened by the opening of said doors, of a motor for closing said draft devices

after the lapse of a time interval operated by the cumulative pressure of steam or other elastic fluid, a valve-controlled port for admitting said fluid to the motor and means for opening said port adapted to be set by the closing of one or more of said doors, and to be operated by the closing of the last door.

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

WILHELM E. NAGEBORN.

Witnesses:
JAMES WHITTEMORE,
M. B. O'DOGHERTY.