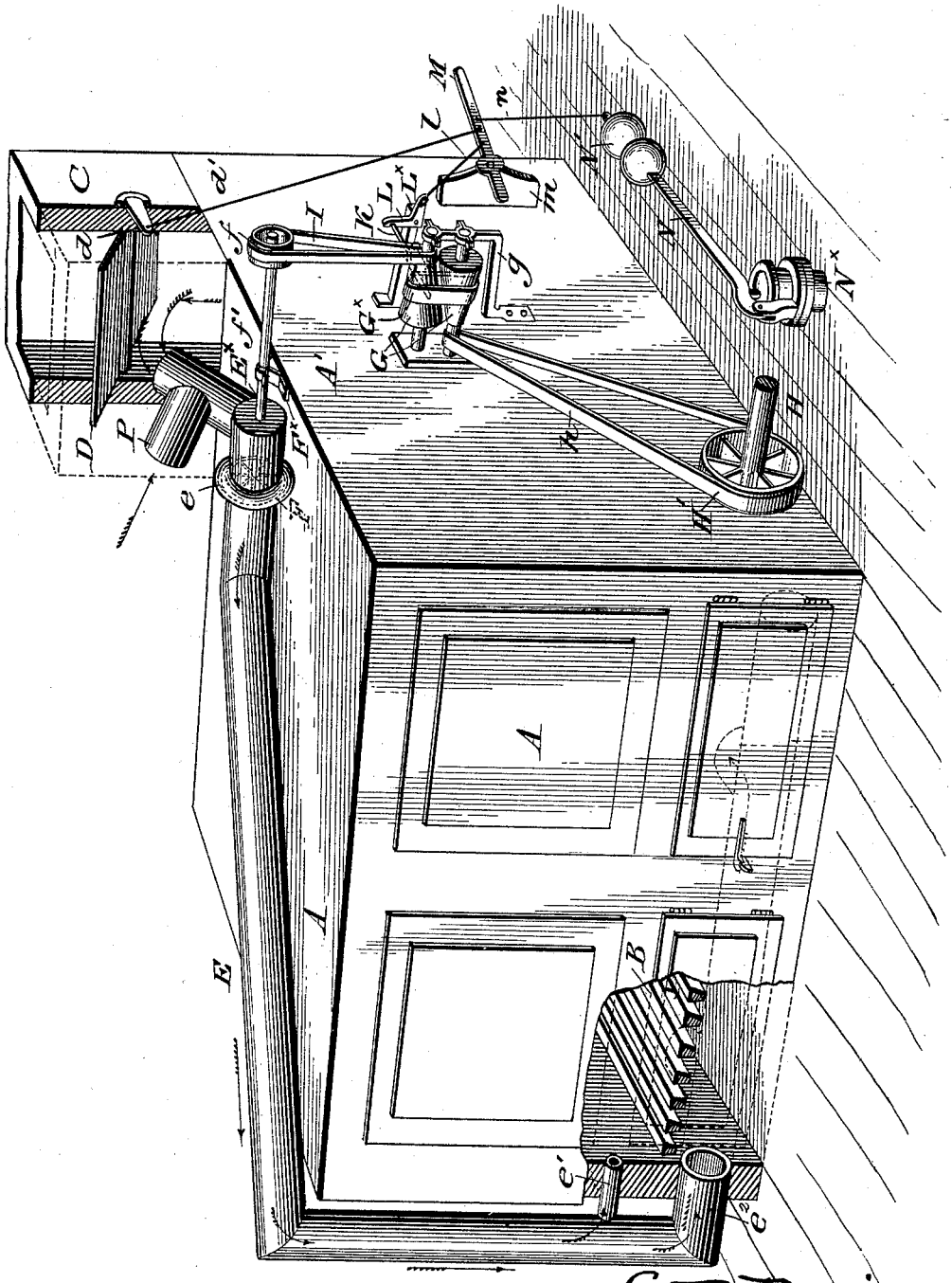
(No Model.)

G. P. DENIS.

FURNACE.

No. 422,187. Patented Feb. 25, 1890.



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FURNACE.

SPECIFICATION forming part of Letters Patent No. 422,187, dated February 25, 1890.

Application filed January 11, 1889. Serial No. 296,092. (No model.)

To all whom it may concern:

Be it known that I, GEFFROY P. DENIS, a citizen of the United States, residing at Chester, in the county of Delaware, and State of Pennsylvania, have invented certain new and useful Improvements in Furnaces, of which the following is a specification.

My invention relates to the class of appliances which are attached to furnaces to arrest the unconsumed products of combustion in the smoke stack and occasion their return to the grate, and also to such appliances as are employed to lead fresh air to the grate to act as a draft.

The object of my invention is the construction of simple, efficient, and automatic apparatus of the character above indicated.

In the drawing I show in a perspective, partly sectional view, a furnace provided with my improvements.

A indicates the furnace and boilers of any preferred character, B the grate bars, and C the chimney.

D indicates a damper supported within the chimney and adapted when closed to completely seal its flue. The damper represented is of the simplest type, and other forms may if desired be substituted in its stead.

E is a pipe or duct, the upper end of which is in communication with the flue of the chimney at a point below the damper and the lower end of which leads to the grate. Intermediate of its length, the pipe is provided with an enlargement *e*, in which rotates an exhaust fan F of any suitable character, conveniently mounted upon a shaft *f'* passing through the pipe E at an elbow $E^{\times}$ thereof, supported upon a bracket $F^{\times}$ attached to the furnace, and at its outer end provided with a band wheel *f*. The pipe E is at a point between the chimney and the exhaust fan provided with an air or oxygen inlet P. This inlet may be a simple orifice in the pipe, or a branch pipe may, as shown in the drawing, lead to it from a more or less remote source of air or oxygen supply. The pipe E as stated terminates at the grate, and preferably has discharge openings or outlet pipes *e'* and e^2 respectively above and below it. The upper outlet pipe is a section of pipe branching from the pipe E, and discharging into the furnace at a point above the grate bars, preferably at an elevation sufficient to clear the fuel upon the grate. In the drawing the lower extremity of the pipe E is introduced into the furnace to constitute the lower outlet pipe e^2. Both the upper and the lower outlet pipes may be branched, turned, or extended, in any manner which will produce the best results.

In the drawing I have indicated in dotted lines an extension of the lower outlet pipe along the front of the grate, the extension embodying two outlets for the contents of the pipe, one beneath each of the boilers with which the furnace is provided, so that the contents of the pipe will be consumed at points where the heat generated will be of greatest advantage. In practice I contemplate extending the lower outlet pipe, placing it in a position just in front of the bridge wall, and, where a plurality of boilers is employed, locating the outlets themselves one under each boiler.

In practice it may be found best to provide, at the points in the grate bars immediately over the outlets of the pipe e^2, spaces between said grate bars of more than the normal width, or openings may be formed in the grate bar surface by entirely removing portions of the grate bars, so that there will be no accumulation of fuel above said outlets to prevent the ascent of the gases and smoke.

G G are a pair of cone pulleys of the ordinary type, mounted in a bracket frame *g*, at the side of the furnace, and $G^{\times}$ is the band common to both pulleys.

H is a power shaft in any convenient manner connected to and driven by the machinery operated by the steam generated in the boilers, upon which shaft is mounted a pulley H', connected by a band *h* to the axle of one of the cone pulleys G G, in the arrangement shown in the drawing the lower one. The location of the shaft H and pulley H' is governed by the surroundings of the furnace.

I is a band connecting the axle of the upper cone pulley to the band wheel *f*. The power derived from the pulley H' is therefore transmitted to and serves to drive the exhaust fan. To shift the belt $G^{\times}$ of the cone pulleys, I employ a fork K, the prongs of which lie one on each side of said belt, and connect the

shank of said fork to one arm of a bell crank lever L pivotally supported upon a bracket $L^{\times}$. To the other arm of said bell crank lever is attached a rigid depending rod *l* the lower end of which is attached to a rocking lever M pivotally mounted upon a bracket *m* so as to be free for a rising and falling movement. *d* is an arm mounted upon one extremity of the axle of the damper D, to the free end of which arm is attached a rigid depending rod *d'* the lower end of which is in turn attached to the rocking lever M.

N is the weight arm of an automatic steam damper regulator,—a device well known to those familiar with the art to which this invention appertains, and which I deem unnecessary to describe otherwise than by saying that its base $N^{\times}$ is in communication with the interior of the boiler, and it is therefore subject to the pressure of the steam by which it is caused to rise and fall, and thereby through the connecting rods control the damper. The amount of pressure which will cause the arm to rise may be predetermined and regulated by the set of the weight N' with which said arm is provided. The outer end of the arm of the regulator is connected by a rigid rod *n* with the end of the rocking lever.

The operation is as follows: When the combustion is low and a small pressure of steam is acting on the regulator $N^{\times}$ the arm of the latter will occupy a depressed position and the lever M will be tilted to a position in which its outer end is much lower than its pivot. The damper D will therefore be closed and through the instrumentality of the bell crank lever and fork the belt $G^{\times}$ will have been caused to occupy a position near the right hand end of the pulleys, so that the speed of rotation given to the band wheel *f* and consequently to the exhaust fan will be augmented. Under these conditions the smoke gases and products of combustion are stopped by the closed damper and by the action of the exhaust fan drawn from the chimney and caused to descend through the pipe E, the fan also serving through the inlet pipe P to suck air or oxygen, which mingles with its contents, into the pipe and becomes heated therein. The amount of air or oxygen which is drawn in will depend upon the size of the inlet and the draft of the fan. The draft created by the fan is sufficiently powerful to prevent the escape of smoke, gases or products of combustion through the inlet. As stated, either atmospheric air, or oxygen of greater or less purity and drawn from a suitable reservoir, will enter the inlet. When the heated commingled smoke, gases, products of combustion, and air or oxygen, reach the lower portion of the pipe E, more or less of the lighter elements among them will escape at the upper orifice or outlet, while the remainder will escape through the lower outlet and be discharged beneath the grate. The draft doors of the furnace are kept constantly closed because the contents of the pipe E act as both draft and feed to the fire. When under this treatment the heat of the fire increases, and the steam has reached a predetermined pressure, the arm of the regulator rises, and by so doing lifts the tilting arm M, which, through the rod *d'* and arm *d* opens the damper, and through the rod *l* raises the outer arm of the bell crank lever and causes the fork thereof to shift the cone pulley belt $G^{\times}$ to the left, with the result that the speed of rotation of the fan is reduced, but a portion of the contents of the chimney and a lesser quantity of air fed to the grate, and the combustion in consequence diminished. As the fire goes down, the steam pressure decreases, thus again causing the closing of the damper, and increasing the speed of the exhaust fan.

By the use of my invention the furnace is caused to consume its own smoke and gases. The combustion of the furnace is automatically regulated and maintained uniform, and the feeding of the contents of the pipe E to the furnace reduces the amount of coal otherwise necessary to be fed to it.

Having thus described my invention, I claim:—

1. In combination with a furnace and chimney, a pipe leading from the chimney to the lower part of the furnace and having outlets discharging respectively above and below the furnace grate, the exhaust fan, the cone pulleys connected therewith, the fork, the bell crank lever, the rocking lever connected to said bell crank lever, the steam regulator connected to said rocking lever, and the power shaft, connected with the cone pulleys, substantially as set forth.

2. In combination with a furnace and chimney, a pipe embodying an air inlet and leading from the chimney to the lower part of the furnace, the damper, exhaust fan, means for operating said fan and said damper and common to both said devices, substantially as set forth.

3. In combination with a furnace and chimney, a pipe leading from the chimney to the lower part of the furnace, a damper, an exhaust fan, mechanism for rotating the fan, mechanism for controlling the rotation of the fan, and an automatic steam regulator connected to the damper and to the mechanism for controlling the speed of the fan, substantially as set forth.

4. In combination with a furnace and chimney, a pipe leading from the chimney to a lower part of the furnace, an air inlet, a damper, an exhaust fan, and mechanism for causing the associated operation of the damper and fan, substantially as set forth.

5. In combination with a furnace and chimney, a pipe leading from the chimney to the lower part of the furnace, the exhaust fan, the mechanism for operating said fan, which mechanism includes a pair of cone pulleys, mechanism for shifting the belt of said pulleys, the damper, an automatic steam regulator, and the rocking lever connected to the

steam regulator, and also connected to the damper and to the mechanism for shifting the belt of the cone pulleys, substantially as set forth.

6. In combination with a furnace and chimney, a pipe leading from the chimney to the lower part of the furnace and having outlets which discharge respectively above and below the grate, the exhaust fan, the mechanism for operating said fan, which mechanism includes a pair of cone pulleys, mechanism for shifting the belt of said pulleys, the damper, an automatic steam regulator, and a rocking lever connected to the steam regulator, and also connected to the damper and to the mechanism for shifting the belt of the cone pulleys, substantially as set forth.

In testimony that I claim the foregoing as my invention, I have hereunto signed my name this 2d day of January, A. D. 1889.

GEFFROY P. DENIS.

In presence of—
F. NORMAN DIXON,
LEWIS ALTMAIER.