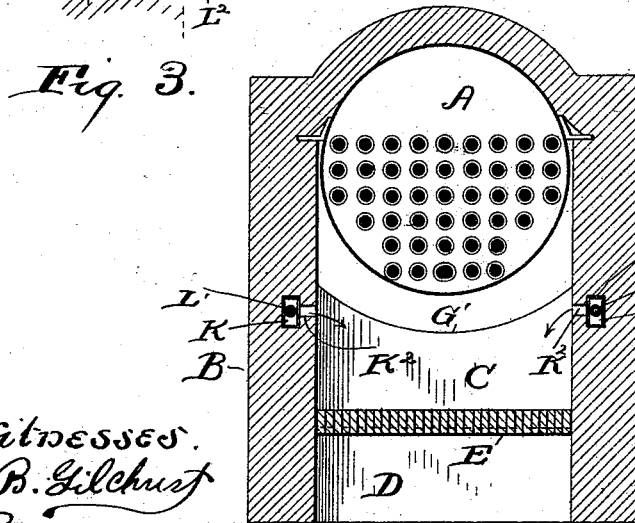
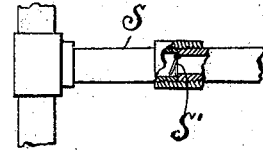
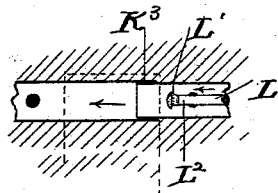
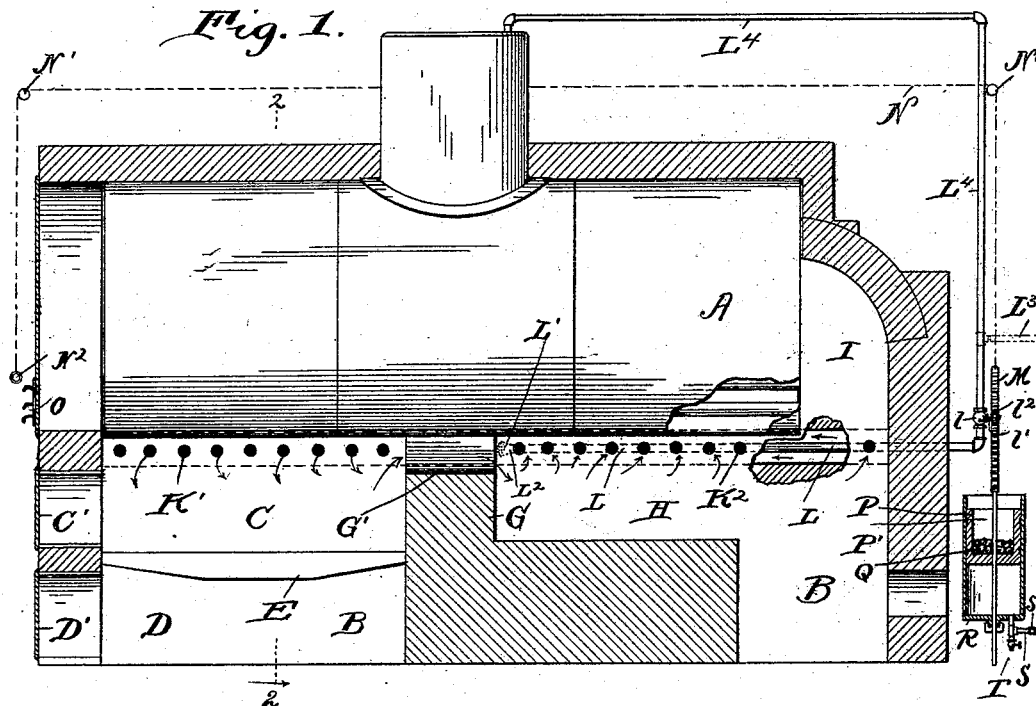


H. ENGEL.
SMOKE CONSUMING FURNACE.

Patented Aug. 14, 1894.



Witnesses.
E. B. Gilchrist
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Inventor:
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UNITED STATES PATENT OFFICE.

HENRY ENGEL, OF WEST CLEVELAND, ASSIGNOR OF ONE-HALF TO AUGUST G. ILG, OF CLEVELAND, OHIO.

SMOKE-CONSUMING FURNACE.

SPECIFICATION forming part of Letters Patent No. 524,317, dated August 14, 1894.

Application filed March 17, 1894. Serial No. 504,016. (No model.)

To all whom it may concern:

Be it known that I, HENRY ENGEL, of West Cleveland, in the county of Cuyahoga and State of Ohio, 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 pertains to make and use the same.

My invention relates to improvements in smoke-consuming furnaces or smoke-consumers; and it consists in certain features of construction and in combinations of parts hereinafter described and pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation, mostly in longitudinal section, of a furnace embodying my invention, portions being broken away to more clearly show the construction. Fig. 2 is an end elevation in vertical section on line 2—2, Fig. 1. Fig. 3 is an enlarged detail in section. Fig. 4 is an enlarged elevation in detail, partly in section.

A designates the boiler of my improved furnace, the same being shown to be of the horizontally-arranged tubular variety and supported between the upper portions of the side-walls B of the furnace-setting in the usual manner.

C designates the fuel or fire-chamber of the furnace, said chamber being shown located under the forward portion of the boiler, and C' represents the door leading to said chamber.

D designates the ash-pit; D', the door leading to said pit, and E, the grate.

G represents a bridge-wall that is shown located at the rear of the fuel-chamber below the central portion of the boiler and extends into suitable proximity to the crown-sheet of the boiler, said wall being preferably concave on its upper side, as at G', and separated preferably about eight inches from the crown-sheet of the boiler. The chamber H, formed at the rear of the bridge-wall, is in open relation with a chamber I at the rear of the boiler, and said chamber I is in open relation with the tubes of the boiler.

A flue or channel K is formed at and preferably within the side-wall or walls of the furnace-setting, one of said channels or flues being preferably provided in each of said walls as shown in Fig. 2. Flues or channels K are arranged lengthwise of the furnace and extend preferably from above the fuel-chamber rearwardly beyond said chamber along the path of the products of combustion. Flues or channels K are in open relation, respectively, with the fuel-chamber of the furnace by means of holes or short ducts K', communication between said chamber and channels or flues K being preferably established by a series of said holes or ducts K' arranged at suitable intervals lengthwise of the channels or flues forward of the bridge-wall. Open relation is also established between chamber H and flues or channels K preferably by means of lateral holes or short ducts K², any suitable number of said holes or ducts being provided and the same being preferably arranged at suitable intervals lengthwise of channels or flues K rearward of the bridge-wall.

A pipe L extends into the rear end of each flue or channel K, said pipe extending preferably forwardly to the central portion of the respective flue or channel and terminating, at its forward end, in a discharging-nozzle L'. Pipes L are adapted to conduct and discharge hot air or steam into the central portion of the respective flue or channel K, preferably within that portion of the respective flue or channel that is located next adjacent to the bridge-wall, and I would here remark that pipes L extend preferably somewhat forward of the most forward duct or passage-way K², as shown at L² in Figs. 1 and 3.

By the construction hereinbefore described it will be observed that in the operation of the furnace with pipes L discharging hot air or steam into the central portion of the respective flue or channel K, suction will be created at holes or ducts K², resulting in the establishment of a circulation or currents in the direction of the arrows, that is, from the fuel-chamber rearwardly into chamber H, or the path of the products of combustion rearward of the fuel-chamber; thence through holes or ducts K² into flues or channels K; thence

forwardly through said flues or channels to holes or ducts K' and thence into the fire or fuel-chamber. Hence, it is obvious that the smoke passing from the fuel or fire-chamber to chamber H over the bridge-wall will be sucked into flues or channels K at holes or ducts K², and will thence be carried forwardly along said flues or channels and discharged into or returned to the fuel or fire-chamber at holes or ducts K', by which circulation the smoke is completely consumed, and has no opportunity to escape. The greatest economy in fuel is therefore obtained by my improved furnace and in a manner that is exceedingly simple and convenient.

I would here remark that if flues or channels K are built of metallic tubes they are preferably built in two sections with the rearward section fitting snugly into the rear end of the forward section, as shown at K³ in Fig. 3, by which construction it is obvious that the burning out of the forward sections of such metallic flues would not necessitate the renewal of the entire flues.

If the suction at holes or ducts K² is created by the discharge of hot air from the discharging-nozzle of pipes L, said pipes are suitably connected with a hot-air-supply-pipe L³, shown in dotted lines, Fig. 1. If steam is used, however, the pipes are suitably connected, by means of pipe L⁴, with the steam-space of the boiler, as shown in solid lines, Fig. 1. Pipes L, preferably just outside of the rear end of the furnace are provided, respectively, with a valve l for regulating the supply of air or steam to the respective pipe. Suitable mechanism is preferably provided for operating said valve from the front end of the furnace. Said valve-actuating-mechanism consists preferably of a pinion l² operatively connecting with the stem l' of the valve, and meshing with a reciprocating-rack M that is arranged vertically, and is operatively connected, at its upper end, with a chain or cable N that leads over suitable guide-sheaves or pulleys N' to the forward end of the furnace and to within convenient reach of the operator and is adapted to be held in the desired adjustment by means of an eye or ring, N², attached to the forward end of the chain or cable and adapted to engage any one of hooks, O, secured at different elevations, respectively, to the furnace-front. The lower end of rack M is operatively connected in any approved manner with a piston or plunger P that is hollow or chambered, as at P', for receiving weights Q. Piston or plunger P is adapted to operate within an upright cylinder R that, at its lower end, is connected with a pipe, S, for supplying air or fluid to the cylinder below the piston or plunger to assist in elevating the plunger or piston and in holding the same at the desired elevation. Pipe S (see Fig. 4) is shown provided with a check or back-pressure-valve S' to prevent the return of fluid from the cylinder, and the cyl-

inder is shown provided with a pet-cock, T, for permitting the escape of fluid from the cylinder when desired.

By the construction just described, it will be observed that the rack M, and consequently the air or steam-supply regulating-valve with which it is operatively connected, is actuated in the one direction or the other to close or open, or more or less close or open said valve according as the aforesaid piston or plunger is elevated or lowered within the inclosing cylinder, and the arrangement of parts is preferably such that said piston or plunger shall be elevated by pulling downwardly upon chain or cable N at the forward end of the furnace, and that said piston or plunger is lowered by loading its chamber with any suitable weights, or by opening the pet-cock to permit a portion of air in the cylinder to escape, or both.

Reissued United States Letters Patent No. 10,044, of February 28, 1882, to Elliott, and United States Patent No. 353,216, of November 23, 1886, to Grewcox and Yeiter, disclose that it is not broadly new to establish a current from the fuel-chamber beyond said chamber in the path of the products of combustion, and thence back into said chamber, and I do not, therefore, desire to be understood as claiming, broadly, means whereby such a current is established.

The object of my invention is to arrange flues or passage-ways K approximately the entire length of the furnace and to provide said flues or passage-ways, rearward of the bridge-wall and at comparatively short intervals, with suction-holes or ducts whereat the smoke or products of combustion is drawn into said flues or passage-ways, and to provide said flues or passage-ways forward of the bridge-wall and at comparatively short intervals, with similar holes or ducts for discharging, into the upper part of the fire or fuel-chamber, the smoke or products of combustion drawn into the flues or passage-ways rearwardly of the bridge-wall.

The accompanying drawings illustrate flues K as extending beyond the rear end of the boiler at the top of the bridge wall, and the portion of said flues or passage-ways rearward of the bridge-wall is provided with suction-holes or ducts K² at comparatively short intervals from at or near the bridge-wall, to and beyond the rear end of the boiler, by which construction the smoke and products of combustion passing over the bridge-wall from the fuel or fire-chamber are bound to be sucked or drawn into said flues or passage-ways owing to the provision of suction-holes or openings K² along the entire path of the smoke or products of combustion between the bridge-wall and the rear end of the boiler; hence, there is little liability of any smoke escaping into the tubes of the boiler. Also, heating-pipes L, that extend into flues or passage-ways K, maintain said passage-ways in a highly heated

condition, and hence the smoke and gases conducted through said flues or passage-ways back into the fire or fuel-chamber, are kept and returned in a heated condition to the fire or fuel-chamber.

What I claim is—

1. In a smoke-consuming furnace, the combination of the fuel-chamber, bridge-wall at the rear of the fuel-chamber, two flues or channels arranged at opposite sides of the furnace, respectively, a suitable distance above the grate-surface of the fuel-chamber at the top of the bridge-wall, said flues extending from the forward end of the furnace rearwardly a suitable distance along the path of the products of combustion rearward of the bridge-wall, said flues or channels rearward of the bridge-wall being provided at comparatively short intervals with suction-holes or ducts, and, forward of the bridge-wall and at comparatively short intervals, having discharging-openings that discharge into the upper part of the fuel-chamber, and suitable means for establishing a current from the path of the products of combustion rearward of the bridge-wall into the aforesaid flues or channels at the suction-holes, thence forwardly through said flues or channels into the fuel-chamber at the discharging-holes in said flues or channels, substantially as set forth.

2. In a smoke-consuming furnace, the combination of the fuel-chamber, bridge-wall at the rear of the fuel-chamber, two flues or channels arranged at opposite sides of the furnace, respectively, a suitable distance above the grate surface of the fuel-chamber at the top of the bridge-wall, said flues extending from the forward end of the furnace rearwardly a suitable distance along the path of the products of combustion rearward of the bridge-wall, said flues or channels rearward of

the bridge-wall being provided at comparatively short intervals with suction-holes or ducts and forward of the bridge-walls and at comparatively short intervals having discharging-openings that discharge into the upper part of the fuel-chamber, and a hot air or steam-pipe leading into the rear portion of said flues and extending forwardly and discharging at or near the bridge-wall, all arranged substantially as shown, for the purpose specified.

3. In a smoke-consuming furnace, the combination with the fuel chamber, flues or channels K K arranged a suitable distance above the grate-surface of the fuel-chamber, said flues extending from above the grate-surface rearwardly a suitable distance beyond the fuel-chamber along the path of the products of combustion, the forward portion of said flues being in open relation with the fuel-chamber, and the rearward portion of the flues communicating with the path of the products of combustion rearward of the fuel-chamber, of a hot air or steam-pipe leading into the rear portion of each of said flues and discharging forwardly into the respective flue, a valve for regulating the supply of fluid to said pipe, a cylinder, a chamber or hollow piston adapted to operate endwise of said cylinder and operatively connected with the aforesaid valve, a valved pipe for conducting fluid to the cylinder below the piston, and a pet-cock for permitting the escape of fluid from the cylinder, substantially as shown and described.

In testimony whereof I sign this specification, in the presence of two witnesses, this 1st day of February, 1894.

HENRY ENGEL.

Witnesses:

C. H. DORER,
WARD HOOVER.