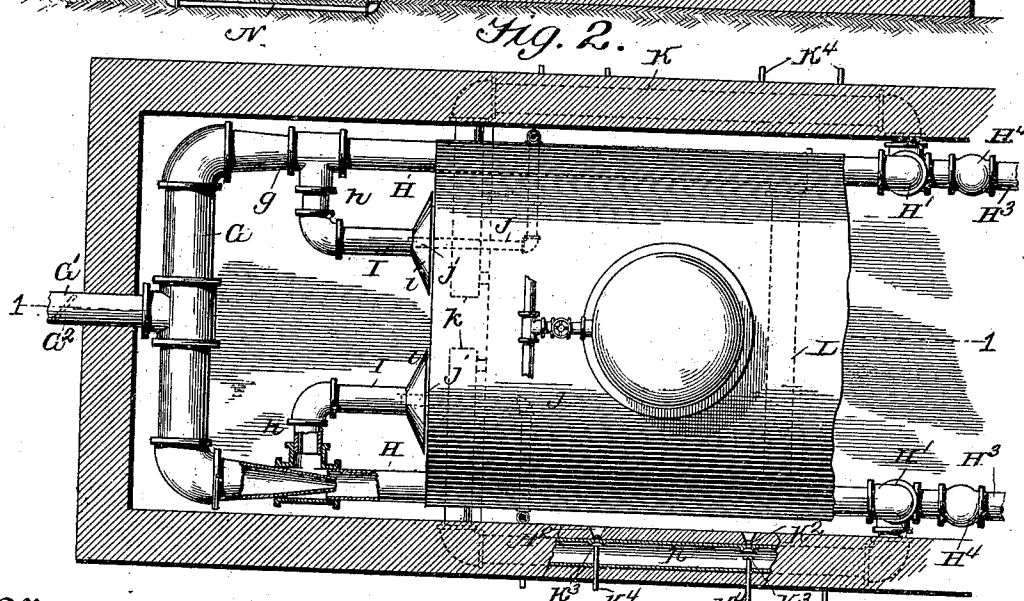
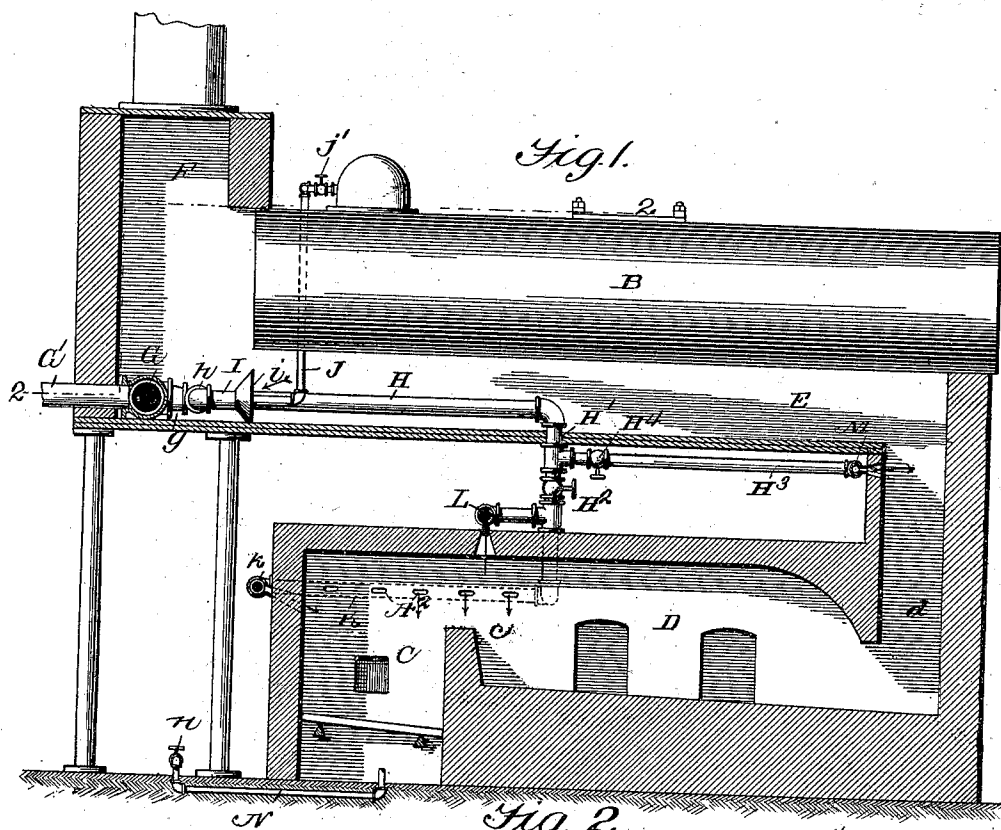


(No Model.)

F. NEVEGOLD.
APPARATUS FOR CONSUMING WASTE GASES.

No. 554,293.

Patented Feb. 11, 1896.



Witnesses.

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UNITED STATES PATENT OFFICE.

FREDERICK NEVEGOLD, OF COLUMBIA, PENNSYLVANIA, ASSIGNOR OF ONE-EIGHTH TO JACOB S. McCLAIN, OF SAME PLACE.

APPARATUS FOR CONSUMING WASTE GASES.

SPECIFICATION forming part of Letters Patent No. 554,293, dated February 11, 1896.

Application filed May 2, 1895. Serial No. 547,932. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK NEVEGOLD, of Columbia, in the county of Lancaster and State of Pennsylvania, have invented certain
5 new and useful Improvements in Apparatus for Consuming Waste Gases in Furnaces; and I do hereby declare that the following is a full, clear, and exact description thereof, reference
10 being had to the accompanying drawings, and to the letters of reference marked thereon, which form part of this specification.

This invention is an improved apparatus for utilizing and consuming the waste gases or products of combustion in heating, scrap
15 and puddling furnaces, and thereby economizing fuel; and its object is to trap the products of combustion just as they would escape into the stack or chimney, and return them
20 or a portion of them back to the fire-chamber, and to utilize these gases to superheat air which is mixed therewith and injected therewith into the fire-chamber to be consumed, the products being repeatedly returned to the
25 furnace until substantially all the carbonaceous matters therein are thoroughly oxidized. The apparatus is also provided with means whereby steam can be introduced into and commingled with the gases and air, this mixture forming a highly-combustible heating-
30 gas, the air and steam being so arranged that either and both will assist in withdrawing the waste products from the flue and returning them to the furnace.

The invention therefore consists in the
35 novel construction and combinations of parts set forth in the claims, and is shown and described as follows, viz:

In the accompanying drawings, Figure 1 is a vertical longitudinal section through a heating-furnace on line 1 1, Fig. 2. Fig. 2 is a
40 horizontal section on line 2 2, Fig. 1.

The furnace A may be of any suitable construction, and is shown as constructed like
45 ordinary heating-furnaces, with a boiler B superimposed thereover. The products of combustion rising from the fire-chamber C in the furnace pass over bridge-wall c, through the chamber D, up through flue d, back through chamber E, below the boiler, to the
50 stack F, as indicated in the drawings.

Within chamber E, just below the uptake

and extending forwardly under the boiler, is the gas-trapping apparatus, consisting of a pipe G, lying transversely of chamber E upon the bottom thereof, and having its ends bent
55 forward and connected to the ends of horizontal pipes H, which extend along the sides of chamber E a suitable distance and connect with vertical pipes H', passing through the floor of the chamber and hereinafter referred
60 to. The ends of pipes H at their junction with pipes G have horizontal inward branches h, which connect with short forwardly-extending pipes I parallel with pipes H, on whose
65 inner ends are gas trapping or collecting hoods i, which open toward the flue d, and are so located that part of the gases flowing through chamber E will be trapped therein. Into these hoods lead steam-jets j on the lower
70 ends of pipes J connected to the steam-dome of the boiler and controlled by a valve j', as indicated in the drawings. These jets will suck the products of combustion into pipes I and force them thence into pipes H.

Pipe G is provided with injector-heads g at
75 its ends, which enter pipes H just at the junction of pipes h therewith, and thus the air which is forced into pipe G through pipes G', connected with an air-forcing apparatus or air-blast, (not shown,) will suck air into pipes
80 H from chamber E, even if the steam-jets be closed.

Preferably pipe G is much larger in cross-section than feed-air pipe G' or the heads g,
85 so that the air will expand therein and become instantly heated before it passes through the injectors g into pipes H. By this preliminary heating and expansion of the air in pipe G the blast through pipes H is rendered more
90 uniform and powerful and there is less expansion and consequent retardation of the air in pipes H.

It is customary for heating-furnaces to employ forced air-blast. Hence it is only necessary to connect pipe G' with the air-blast
95 apparatus which is already in use when applying the invention to old heating-furnaces.

Pipes H' are provided with regulating-valves H² and connect at bottom with pipes K, passing horizontally along the sides of the
100 fire-chamber and provided with jet-tubes, through which the mixed air and gases and

steam are jetted into the fire-chamber, as indicated in the drawings.

Pipes K connect with a transverse pipe *k* at the end of the fire-chamber, that is also provided with jets, through which the gases are injected into the fire-chamber above the fuel but below the top of the bridge-wall.

Pipes H' also supply air to a transverse pipe L, arranged near to and parallel with the bridge-wall *c* and provided with jets, by which the gases can be injected downwardly into the products of combustion passing over the bridge-wall.

The jets from pipes K, *k*, and L may be arranged in any suitable manner, so that these pipes will be protected from the intense heat. In practice pipes K may be inclosed in the walls of the furnace or when applied to an old furnace they may be arranged exterior thereto and passages bored through the furnace-walls for the introduction of the gas-jets.

As shown, pipes K are embedded in the side walls and provided with short jet-tubes K², leading into flaring openings A² in the sides of the fire-chamber. The jet-tubes K² can be closed by valves K³, having stems K⁴ projecting through the pipes and side of furnace, as indicated in the drawings, or other suitable valves may be used. By this means the amount of gases and air and the points of introduction thereof into the furnace can be regulated at will.

Above valves H² pipes H' connect with a pipe H³, provided with a valve H⁴ and connecting with a pipe M, extending transversely across flue *d* and provided with jets *m*, leading thereinto, so that when desired a portion of the gases may be introduced into said flue and combustion increased in chamber E beneath the boiler; also, as it may sometimes be desired not to run the furnace or introduce gases into the chambers C D, the flue *d* may be alone supplied with the gases and combustion maintained in chamber E sufficient to keep up steam in the boiler.

As the air-blast would be constant, by opening valve H⁴ pipes G H would always be kept about at the same temperature, even if valve H³ was closed, and by partially opening valves H³ H⁴ the amount of mixed air and gases, &c., introduced into the fire-chamber C and flue *d* can be regulated as desired.

In practice there should be the usual air-blast pipe N below the grate, as indicated in the drawings, provided with a valve *n*, so that sufficient draft can be had through the bed of fuel on the grate to maintain combustion.

In operation the blast beneath the grate should be reduced, or only used at intervals to maintain combustion. The air driven into pipe G and through injector *g* into pipes H sucks therein products of combustion from chamber E and mixes therewith in passing through pipes H, and thence escapes through pipes K *k* L into the fire-chamber in the most advantageous positions to be incorporated

and commingled with the gaseous products of combustion rising from the grate, and the large quantity of oxygen in the mixed air and gases thus injected into the fire-chamber causes a very fierce combustion in chambers C and D of the carbonaceous matters in the gases, and in repassing through chamber E a greater or less portion of the gases is sucked back into pipe H and are reoxidized and burned in chambers C D, as before. The intensity of the combustion, the violence of the draft, and the volume of waste gases returned to the furnace can be augmented by turning on the steam-jets, as is evident. Thus there is a circulation of gases in an endless path through chambers C D *d* E and pipes H H' K *k* L, resulting in the almost perfect combustion of all oxidizable and combustible gases and particles of carbon escaping from the fuel on the grate. The air coming into pipe G expands and is heated by conduction and radiation of the heated walls of chamber E and also further heated by mixture with the waste gases in pipes H, the air keeping the pipes at a safe temperature and the gases heating the air in the pipes.

The pipe G' may be provided with a valve G², so that, if desired, the air can be wholly or partially shut off.

With this apparatus therefore I can inject mixed air and products of combustion or mixed steam and products of combustion, or mixed air, steam and products in regulated quantities and of the character best suited to the work being done in the furnace.

Having thus described my invention, what I therefore claim as new, and desire to secure by Letters Patent thereon, is—

1. The combination of a furnace, an air-heating pipe or chamber in the outlet-flue thereof but not communicating therewith, means for supplying air under pressure to said pipe, and pipes for returning products of combustion from the outlet-flue of the furnace to the combustion-chambers thereof, with the injectors connecting the air-heating pipe or chamber with the return-pipes, whereby the hot air escaping from the heating-pipe into the return-pipes creates a suction and withdraws products of combustion from the flue, mixes them with air and returns the mixture into the combustion-chamber, substantially as and for the purpose described.

2. The combination of the furnace, an air-heating pipe or chamber in the outlet thereof, means for supplying air under pressure to said pipe, and pipes for returning products of combustion from the outlet-flue of the furnace to the combustion-chambers thereof, with the injectors located in the outlet flue or chamber and connecting the air-heating pipe or chamber with the return-pipes, whereby the hot air escaping from the heating-pipe into the return-pipes creates a suction in the return-pipes and returns products of combustion mixed with air into the combustion-chambers, and steam-jets also communicating with

said return-pipes exterior to the junction of the air-pipes therewith, for the purpose and substantially as described.

3. The combination of a furnace, the air-heating pipe G in the outlet thereof, the compressed-air supply to said pipe, the injector-nozzle *g* on the end thereof within the outlet of the furnace opening into a pipe H, the pipe H communicating with the outlet-flue of the furnace and adapted to withdraw products of combustion therefrom, and the air and gas jet-pipes communicating with the combustion-chambers of the furnace, and connections between pipe H and said jet-pipes, substantially as described.

4. The combination of the furnace, the jet-pipes communicating with the combustion-chambers thereof, the pipes *h* and I in the outlet of the furnace-pipe I opening into said flue, the pipes H, H', connecting pipes *h* with the jet-pipes; the steam-jets *j* opening into pipes I, and the regulating-valves on pipes H' with the air-heating pipe G in the outlet of the furnace, having injectors *g* leading into pipes H at the junction of pipes *h* therewith, and means for supplying fresh air to pipe G, all substantially as described.

5. The combination with a furnace having a fire-chamber, and two successive combustion-chambers as D and E connected by an intermediate flue *d*; of means for trapping the waste products of combustion issuing from chamber E; and mixing them with air or steam, pipes for conducting a portion of the mixed air and products back into the fire-chamber, and pipes for introducing a portion of said waste products and air into the flue *d*, for the purpose and substantially as described.

6. The combination of the furnace, the jet-pipes communicating with the combustion-chambers thereof; the valved pipe H' connected to said jet-pipes, the pipe I opening into the outlet-flue, the pipe H connecting pipe I with pipe H', the air-heating pipe G, means for supplying air thereto under pressure, the injector *g* on said pipe communicating with pipe H at the junction of pipe I therewith,

substantially as described and for the purpose set forth.

7. The combination of the furnace, the jet-pipes communicating with the combustion-chambers thereof; the valved pipe H' connected to said jet-pipes, the pipe I opening into the outlet-flue, the pipe H connecting pipe I with pipe H', the air-heating pipe G, means for supplying air thereto under pressure, the injector *g* on said pipe communicating with pipe H at the junction of pipe I therewith, and the steam-jet pipe *j* opening into pipe I, substantially as described and for the purpose specified.

8. The combination with the furnace having fire-chamber C, combustion-chamber D, flue *d*, combustion-chamber E, and outlet F, the jet-pipes communicating with the fire-chamber, and the jet-pipes communicating with flue *d*, of the traps *i*, the pipes I, *h*, and H, in chamber E pipes I communicating therewith, the valved pipes connecting pipes H with the jet-pipes, the air-heating pipe G, in chamber E having injectors *g* on its ends entering pipes H, and means for supplying air to pipe G, all substantially as described.

9. The combination with the furnace having fire-chamber C, combustion-chamber D, flue *d*, combustion-chamber E, and outlet F, the jet-pipes communicating with the fire-chamber, and the jet-pipes communicating with flue *d*; of the pipes I, *h*, and H, in chamber E, pipes I communicating therewith the valved pipes connecting pipes H with the jet-pipes, the air-heating pipe G, in chamber E, having injectors *g* on its ends entering pipes H, means for supplying air to pipe G, the hoods *i* on the ends of pipes I, and the steam-jets *j* entering said hoods, all substantially as and for the purpose set forth.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

FREDERICK NEVEGOLD.

Witnesses:

JAMES R. MANSFIELD,
ARTHUR E. DOWELL.