

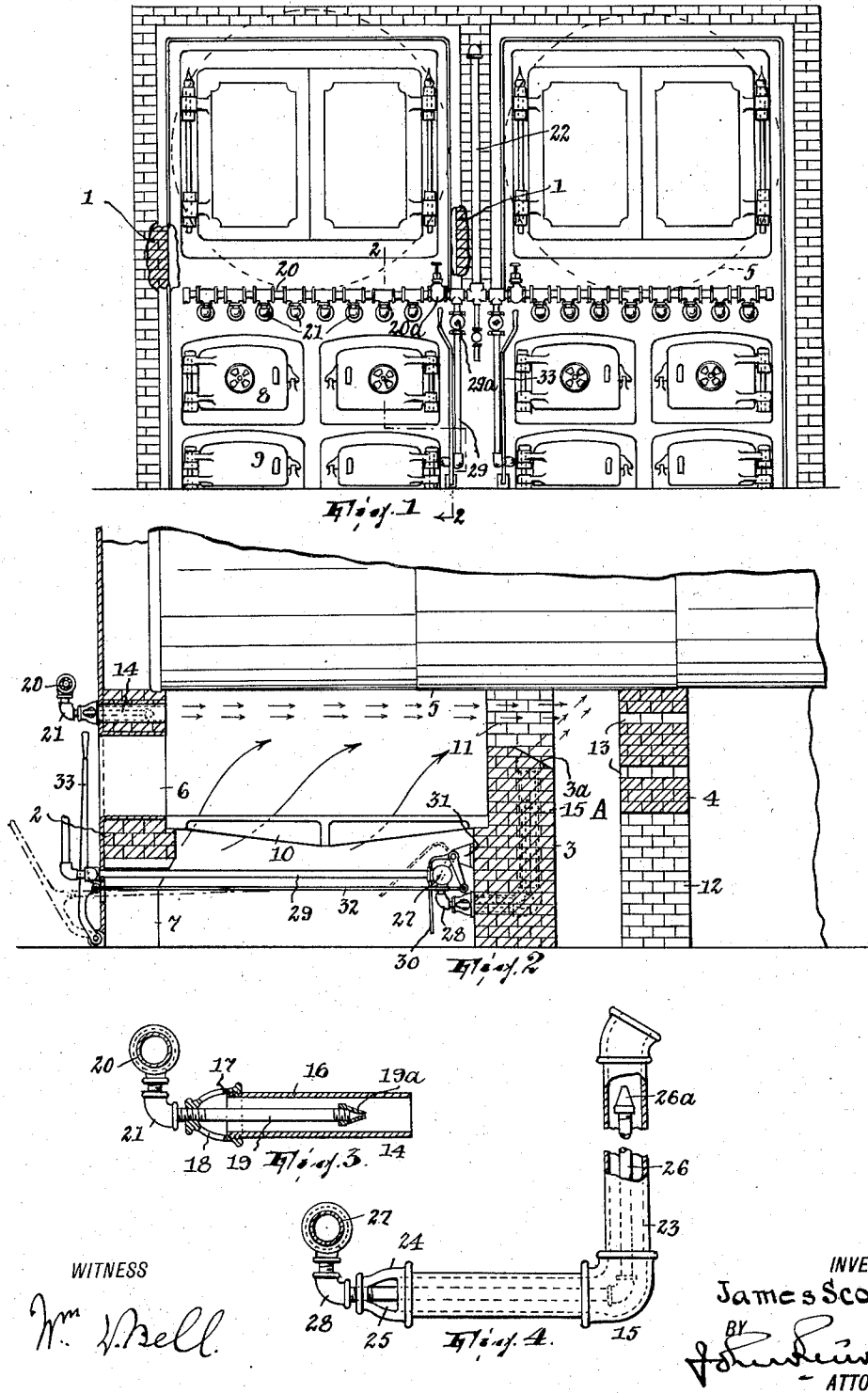
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J. SCOGNIO

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FURNACE

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JAMES SCOGNIO, OF PATERSON, NEW JERSEY

FURNACE

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The object of this invention is to provide a furnace with means for causing combustion of those gases and fuel particles which ordinarily escape and hence not only produce smoke but involve appreciable fuel waste. It is known that if air and steam be injected into a furnace relatively above the fire the combustion will be improved, and my invention contemplates the employment of means for introducing air and steam in this general way. But by constructing a furnace substantially as I shall hereinafter describe and claim it is found in practice that the smoke is reduced to an extent much more complete than has heretofore been accomplished where air and steam are injected, and that there is a corresponding gain in economy. My construction is also such as to facilitate the assembling of the improved furnace structure in the first instance, adapt all parts thereof for long continued use without repairs and attention to keep them in order and permit control of the combustion process under certain conditions.

In the drawing,
Fig. 1 is a front elevation of the furnace structure embodying the invention;
Fig. 2 is a section on line 2—2, Fig. 1;
Fig. 3 is a vertical section of one of the injecting devices used in the front furnace wall; and
Fig. 4 is a side elevation, partly in section, of the injecting devices used in the bridge wall.

Let 1 designate the side walls of a furnace and 2, 3 and 4 the front wall, bridge wall and arch on which in the usual way a boiler 5 is supported. The front wall has the usual firing opening or openings 6 and an ash-pit opening or openings 7 and these have the usual doors 8 and 9 respectively. 10 is the fuel support or grate supported in the usual way on the front wall and bridge wall. There is the usual opening 11 in the bridge wall subjacent to the boiler, and the arch 4, whose opening 12 is below and out of opposition to the opening 11, may have small ports 13 therethrough, as usual, so that the arch, which I prefer to place in relatively close relation to the bridge wall, will act to retard the progress of the fuel elements from the combustion chamber above the fire grate without unduly obstructing the draft. The openings 11 and 12 form, with the space intervening between the bridge wall and arch, a passage A leading, to the stack (not shown).

In Fig. 1 the structure shown embodies two furnaces and their boilers placed side by side, but the number of furnaces in a battery is of course immaterial.

A row of injecting devices 14, extending as such row transversely of the furnace, is arranged over the firing opening or openings and in the front wall of the furnace and so as to discharge over the fire in the combustion chamber and toward the opening 11 to passage A, and another row of said devices 15, extending as such row transversely of the furnace, is arranged to discharge rearward of the fire and generally across the passage. These two rows of injecting devices are for delivery of air and steam, and they deliver the air and steam in two sheets which not only converge, as will be seen in Fig. 1, in the general direction of flow via passage A but form an angular moving fluid barrier through which all unconsumed gases and fuel particles must pass in order to escape. Each of the devices 14 (Fig. 3) comprises a sleeve 16 having one end open and the other provided with a cap 17 having air inlet holes 18 and the tube portion of a steam nozzle 19, axially related to the sleeve, screwed into it, the discharge end or nozzle proper 19^a of the nozzle being within the sleeve. The sleeves of these devices are embedded in the front wall 2 so as to extend horizontally and with their caps projecting at the front, and the nozzles 19 of all these devices are connected to a horizontal steam header 20 by connections 21. The header has a shut-off valve at 20^a. This header takes its supply of steam from a pipe 22 which may be connected with the boiler for its supply. Each device 15 comprises an elbow sleeve 23 having one end open and the other end provided with a cap 24 having air inlet holes 25 and a steam nozzle 26 of elbow form contained in and extending axially through the sleeve and screwed into the cap 24 and having its nozzle proper 26^a

within the sleeve. The sleeves of these devices are embedded in the bridge wall 3 as shown in Fig. 2 or so that their caps protrude at the front of the bridge wall and below the grate and their open ends project upwardly; the upper ends of the sleeve 23 are diverted rearwardly at an angle of about 45 degrees and are about flush with the surface 3^a of the bridge wall 3, which at this point is beveled. The nozzles 26 are all connected to a horizontal header 27, arranged under the grate, by elbow connections 28, and this header receives steam by pipe 29 which may extend forward through the front wall of the furnace under the grate and receive steam from the boiler, as being connected with the header 20 as shown in Fig. 1. In pipe 29 is a shut-off valve 29^a for the header 27.

The periods when smoking of a furnace and hence fuel waste incident thereto are greatest is when fresh coal is thrown on the fire. It is in these periods that my invention is especially applicable. At that time both sets of injectors are made active by turning on the steam, resulting in steam and air (admitted at the air-inlets 18—25) being directed into the furnace in two sheets, one rearwardly from the front furnace wall over the fire toward and into the intake end of passage A and the other within and across this passage in an upward rearward direction, the two sheets converging within the passage. In consequence the unburned fuel particles and gases cannot progress through the passage without passing through the barrier formed by these two sheets of steam and air and on account of the conflict of the two sheets where they converge said particles and gases become thoroughly commingled with the air and steam, in consequence of which their complete combustion follows and no smoke escapes from the stack. When the period has passed where without utilizing my invention fuel particles and gases would escape unburned from the furnace the injector row 15 is put out of action by closing valve 29^a, leaving the other injector row in action if desired.

I am aware that it has been proposed to inject in a furnace a sheet of air and steam from the front furnace wall over the fire; I am aware that it has also been proposed to inject a sheet of air and steam across such a passage as A. But so far as I am aware I am the first to combine the two with the result that the two sheets—one over the fire and the other traversing the passage—not only act to form together a perfect fluid barrier through which the unburned fuel particles and gases must pass in order to reach the stack but converge in the passage, thus setting up a whirling within the same which causes the desired thorough commingling of the air and steam with the fuel elements. Where only the first-named sheet of air and

steam is used the secondary combustion intended to take place in the passage A is only imperfectly accomplished, apparently because the steam and air on the one hand and the gases and particles rising from the fire on the other hand tend to take parallel courses through the passage; and where only the second-named sheet of air and steam is used, while it serves more or less as a barrier through which the unburned gases and fuel particles must pass, it retards the draft and consequently the combustion of the main body of fuel on the grate. By my invention the unburned fuel particles and gases are consumed without impeding the draft. Important factors in the accomplishment of this result are that, since the convergence of the two sheets actually takes place in the passage A, the whirling action which ensues and promotes commingling of the air and steam and fuel elements and which progresses through the passage, is generated within the same, and that since the only way of escape after opening 11 is passed is downward the whirling action, rather than a tendency of the two sheets to assume parallel courses through the passage, result.

A further feature of my invention consists in providing a baffle 30 hinged in brackets 31 at the front of the bridge wall over the caps of the injecting devices 15 and having an arm thereof connected by a link 31 to a hand lever 32 at the front of the furnace. When the steam for devices 15 is cut off this baffle is shifted from the dotted-line to the full-line position in Fig. 2 and acts then to prevent an undesirable cooling draft of air from entering the passage A via the sleeves 23. It also serves as a control for the fire, when in the dotted-line position permitting a check-draft to take place.

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

1. A furnace having a combustion chamber, a fuel support therein and a smoke outlet passage leading from its combustion chamber rearward of and above the fuel support and means to inject two sheets of steam and air into the furnace, one directed over the fire rearwardly into said passage and the other directed transversely of the passage and converging with the first sheet rearward of the fuel support, and the transverse dimension of each sheet extending substantially horizontally and transversely of the furnace.

2. A furnace having a combustion chamber, a fuel support therein and a smoke outlet passage leading from its combustion chamber rearward of and above the fuel support and means to inject two sheets of steam and air into the furnace, one directed over the fire rearwardly into said passage and the other directed transversely of the passage and converging with the first sheet within the passage and the transverse dimension of each

sheet extending substantially horizontally and transversely of the furnace.

3. A furnace having a combustion chamber, a fuel support therein and a smoke outlet passage leading downwardly from its combustion chamber rearward of and above the fuel support and means to inject two sheets of steam and air into the furnace, one directed over the fire rearwardly into said passage and the other directed transversely of the passage and converging with the first sheet within the passage and the transverse dimension of each sheet extending substantially horizontally and transversely of the furnace.

4. A furnace having a combustion chamber, a fuel support therein and a smoke outlet passage leading from its combustion chamber rearward of and above the fuel support and means to inject two oxygenic sheets into the furnace, one directed over the fire rearwardly and substantially toward said passage and the other directed upwardly and converging with the first sheet rearward of the fuel support and the transverse dimension of each sheet extending substantially horizontally and transversely of the furnace.

5. A furnace having a combustion chamber, a fuel support therein and a smoke outlet passage leading from its combustion chamber rearward of and above the fuel support and means to inject two heated oxygenic sheets into the furnace, one directed over the fire rearwardly and substantially toward said passage and the other directed upwardly and converging with the first sheet rearward of the fuel support and the transverse dimension of each sheet extending substantially horizontally and transversely of the furnace.

6. A furnace having a combustion chamber, a fuel support therein and a smoke outlet passage leading from its combustion chamber rearward of and above the fuel support and means to inject two oxygenic sheets into the furnace, one directed over the fire rearwardly and substantially toward said passage and the other directed upwardly and converging with the first sheet toward said passage and the transverse dimension of each sheet extending substantially horizontally and transversely of the furnace.

In testimony whereof I affix my signature.

JAMES SCOGNIO.

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