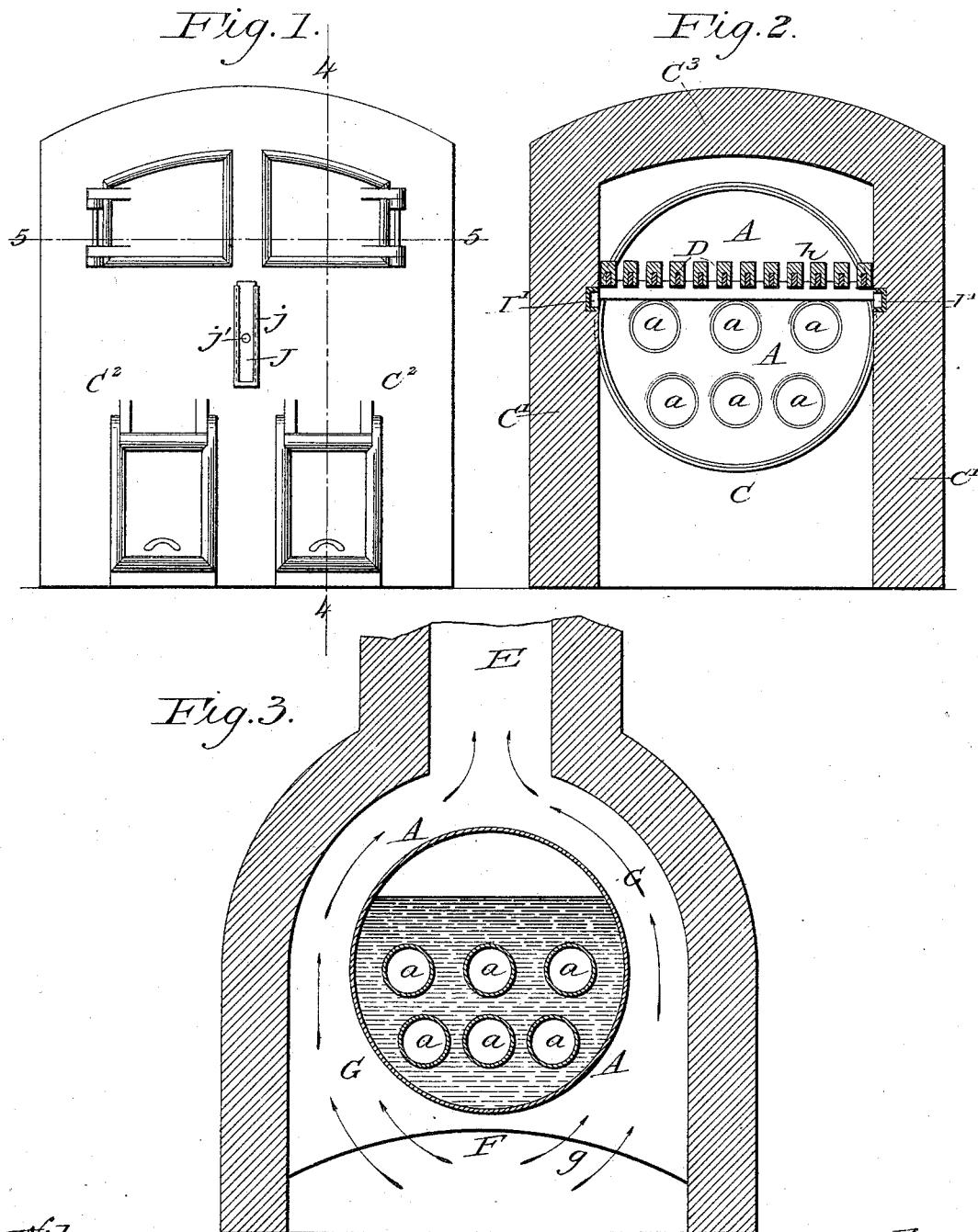


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SMOKE CONSUMER.

No. 341,897.

Patented May 18, 1886.



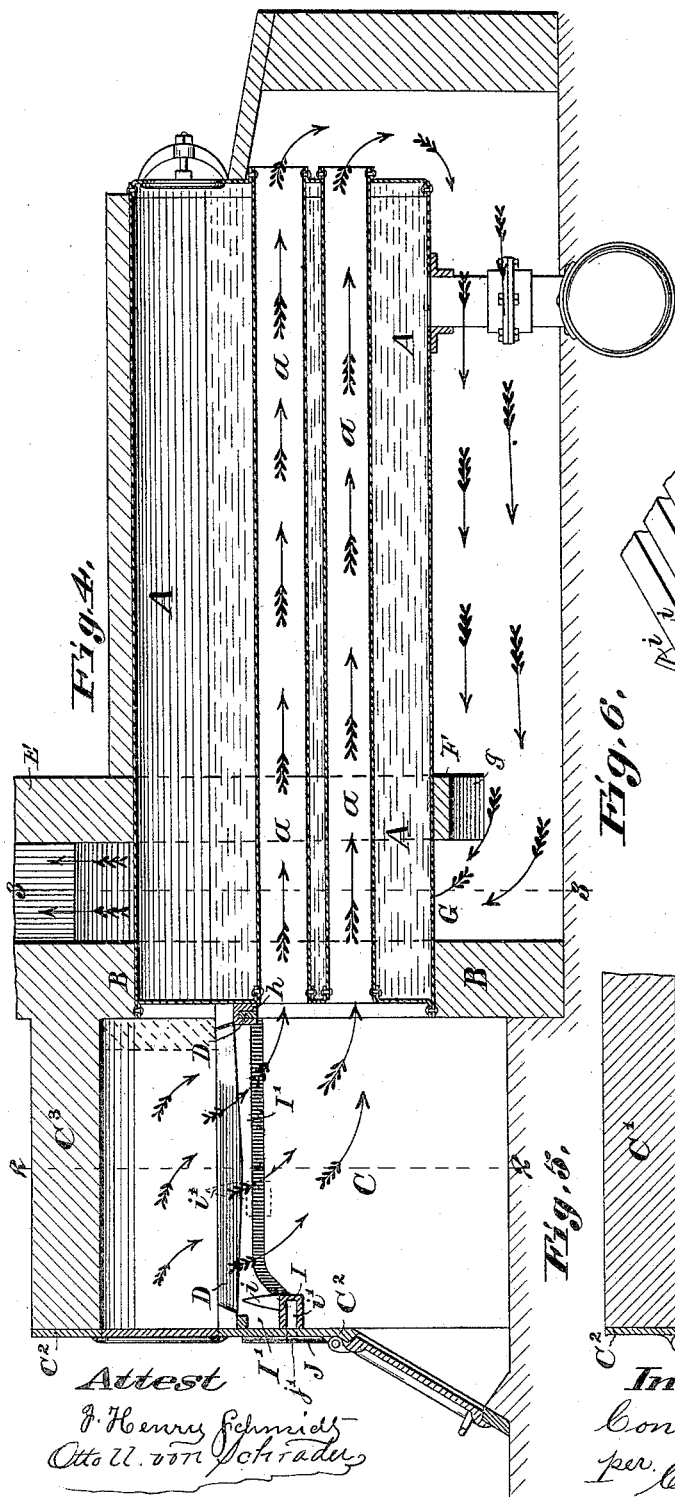
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UNITED STATES PATENT OFFICE.

CONRAD FINK, OF ST. LOUIS, MISSOURI.

SMOKE-CONSUMER.

SPECIFICATION forming part of Letters Patent No. 341,897, dated May 18, 1886.

Application filed January 18, 1886. Serial No. 188,968. (No model.)

To all whom it may concern:

Be it known that I, CONRAD FINK, a citizen of the United States, residing at St. Louis, in the State of Missouri, have invented certain new and useful Improvements in Smoke-Consumers, of which the following is a specification.

This invention is specially adapted to horizontal tubular stationary boilers, but may be so modified as to be adapted for use in locomotive, upright, or other boilers.

As is well known, the usual construction of the furnace and grate, and their relative positions to the boiler with its flues or tubes, is such that the front of the boiler extends over the fire-bed in the furnace, and the front end of the boiler, with the tubes, communicates with the smoke-box in front of the furnace-wall. The draft to the fire is from below upward through the grate and fire-bed, and the fire, flames, gases, smoke, and unconsumed particles of combustion pass along under the boiler to its rear end, thence upward and entering the tubes at this end of the boiler, returning forward through the flues or tubes into the smoke-box at the front of the furnace, and thence through the stack or chimney into the open air. In this construction of the furnace, grate, and boiler, and their arrangement, and especially in the mode or manner of receiving the draft and passing the fire, &c., through the tubes of the boiler, a great amount of unconsumed particles of combustion passes away without any benefit being derived therefrom, and great volumes of smoke are formed through the incomplete process of combustion, caused by the particles of combustion, smoke, gases, &c., rising directly upward from the fire-bed without being subjected to the direct action of the fire, and thus are not ignited or burned, and especially is this the fact whenever fresh fuel is introduced into the furnace; further, the draft being from below upward through the fire-bed, about ten per cent. of combustible matter in the fuel is lost and unutilized, owing to the fact that the cold draft striking the hot or live coals underneath extinguishes them, causing clinkers to be formed of them, which still contain about ten per cent. combustible matter of the original fuel. These clinkers are wasted, and consequently so much combustible matter is unutilized and lost.

The object of my invention is to overcome all these disadvantages, difficulties, &c., and to form a perfect smoke-consumer, whereby all smoke and all particles of combustion are fully and entirely consumed and utilized, as well as effecting a more perfect and direct heating of the water in the boiler.

To this end my improvements consist in arranging the furnace directly in front of the boiler and making it of sufficient height and width to extend across the entire front of same; further, in arranging the grate high within the furnace, and so that the bottom of the grate-bars will be above the upper tubes of the boiler, and the fire-bed will be about even with the normal water-line in the boiler; further, in admitting the draft to the fire from above the grate-bars, so that the former will pass downward through the fire-bed and grate, the space below the grate being made air-tight at its door and walls, so that all smoke and particles of combustion will be forced to pass through the fire-bed, and thus be effectually burned and consumed; further, in the direct manner of passing the flames and heat into the flues of the boiler in front to gain full benefit therefrom; and, further, in the construction of detail parts, all of which will hereinafter be fully described.

Of the drawings, Figure 1 is a front elevation of my improved furnace. Fig. 2 is a vertical section through same on line 2 2 of Fig. 4, clearly showing the grate and its relative position to the front of a boiler. Fig. 3 is a cross-section through the front end of a boiler and middle of chimney on line 3 3 of Fig. 4, clearly showing how the heat and fire pass around the front end of the boiler into the chimney. Fig. 4 is a longitudinal section of the furnace, with its grate, and the boiler, with its fire-tubes, on line 4 4 of Fig. 1, clearly showing arrangement and position of the former to the latter, also indicating direction of draft and course of fire and heat by arrows. Fig. 5 is a plan section of the furnace, looking down on the grate. Fig. 6 is a perspective view of the grate-bars, showing their detail construction, also mechanism for raking the fire.

Similar letters refer to similar parts throughout the several views.

A represents a plain stationary cylinder-boiler. *a* are its flues or fire-tubes. The

boiler rests with its front end in a fire-brick wall, B, so that its front face should come about flush with the front face of the wall. This wall is built air-tight, and should encircle the boiler, as shown in Figs. 2 and 4. Directly in front of the boiler I build my furnace C by extending the side walls, C', forward, connecting them with the front furnace-wall, C², which may be of iron or brick, and arching the whole over at the top by a brick arch, C³, the wall B and face of the boiler forming the rear wall of my furnace. (See Fig. 4.)

D is my grate. This I place high up in the furnace, so that the bottom of its bars will be directly above the upper fire tube or tubes of the boiler, and so that the fire-bed will be about even with the normal water-line in the boiler. The walls and doors of the furnace below the grate should be perfectly air-tight, so as to prevent any and all draft from entering the furnace below the fire-bed and grate. The fire-doors above the grate, however, will be kept open, or provided with openings to admit draft from above the grate and fire-bed downward through same, as indicated by arrows, Fig. 4.

The object of placing the grate as described is to permit the fire and heat to pass down through the grate and directly into the flues of the boiler, so that the most benefit is derived therefrom. Further, the object of bringing the fire-bed about even with the normal water-line in the boiler is to prevent the boiler from burning through at this point, which is protected by the water. Where the fire-bed extends above the water-line a brick wall should be built across the face of the boiler above the grate, as shown by dotted lines in Fig. 4.

Directly back of the furnace I place my chimney or stack E.

F is a brick wall surrounding the boiler, a little distance back of the wall B, so as to form a chamber, G, around the boiler, and connecting with the chimney above it. The wall F is arched below to leave an opening at *g*. The fire and heat, after entering the boiler-tubes in front, pass through same to the back, returning by passing down in the rear and under the boiler into the chamber G, around the boiler into the chimney.

The main feature of my invention, and upon which I lay most stress, is the position of the grate within the furnace, together with its relative position to the boiler and the relative position of the boiler to the furnace, whereby the heat and flames from the fire-bed are compelled to pass down through the grate and directly into the flues or fire-tubes of the boiler, thus utilizing and deriving the benefit from same when hottest, the advantages gained being as follows: The smoke thus being compelled to pass directly through the fire, thereby being completely burned and converted into heat and flames. Further, the particles of combustion cannot escape unconsumed, they being also passed directly through

the fire and flames downward, and are thus completely burned and also converted into heat and flames, the heat and flames thus formed being entirely free from smoke and unconsumed particles of combustion, and doing away with the nuisance of smoking chimneys and danger of flying sparks, as well as deriving full benefit from heat formed by entire burning of same. Further, a more perfect burning of the fuel itself is obtained, as no cold draft can strike the live coals from below to extinguish them before all the combustible matter contained in them is fully utilized.

To protect the grate and grate-bars against the intense heat to which they are subjected by the flames and fire which pass downward between them, I prefer to use a grate constructed as follows: *h* represents fire-clay, which is formed around the grate-bars and other parts of the grate subjected to the fire. This clay is placed on the bars, &c., damp, and covers top and sides completely. (See Fig. 6.) After the fire has acted on it some time it becomes hard and forms a fire-clay covering; or it may be placed on and burned in any other well-known manner.

I is a rod running in guides I' below the grate, parallel to the grate-bars and secured in the side walls of the furnace. This bar has formed on its top fingers *i*, which extend up into the spaces between the grate-bars.

i' is a sleeve, into which a rod may be inserted from outside of the furnace in order to move the bar back and forth and cause the fingers to rake the ashes and cinders out of the grate. The front end of the guides are made to incline downward, so as to allow the bar with its fingers to be dropped down below the grate, and thus placed out of reach of the flames, and prevent their being burned through the intense heat when not in use.

J is a plate moving in guides *j*, air-tight, on the front wall of the furnace. A hole, *j'*, in the plate admits of a rod to be inserted for engagement with the sleeve of the rake-bar. This air-tight plate J allows the rod to move upward when pushing the rake-bar up the inclined portion of the guides for bringing the fingers between the grate-bars.

What I claim is—

1. The combination and arrangement, in a downdraft-furnace, of a grate placed directly in front of a steam-boiler, and directly above its upper flue or flues, as herein shown and described, and for the purpose of conducting the flames directly into the flues of the boiler, for the purpose set forth.

2. In a downdraft-furnace for steam-boilers, the front face of a tubular boiler forming the rear wall or part of the rear wall of the furnace, and the grate placed above the upper flue or flues of said boiler, substantially as herein shown and described, and for the purpose set forth.

3. In a furnace, the combination of the wall B of the furnace proper with the wall F around the boiler to form a heating-chamber, G, com-

municating with the chimney E, as herein shown and described, and for the purpose set forth.

4. The combination, with a steam-boiler
5 having a heating-chamber, G, communicating with the chimney E, as herein shown and described, of a downdraft-furnace directly in front of said boiler, and a grate within the fur-

nace, placed directly in front of said boiler and directly above its upper flue or flues, substantially as and for the purpose set forth.

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Witnesses:

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