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WROUGHT IRON TUBULAR SAFETY BOILER.

The inventors of the improved steam generator herewith illustrated hold that the principle of having a boiler directly over the fire is wrong, inasmuch as the heated gases, ranging from 1,700° to 2,000° Fah. in temperature, when striking the cooler surfaces so near them, which are heated only to about 300°, become condensed, and, as a result, there is imperfect combustion, smoke, and a large expenditure of fuel. To obviate this difficulty the present boiler was constructed, so that a flame from 12 to 18 feet in length is obtained, wherein, it is claimed, almost all gases, etc., are consumed. Actual tests made upon a boiler in use at the Centennial Exhibition demonstrate the temperature of the escaping gases to be very nearly of the same degree as the steam, in lieu of from 600° to 1,200°, as is commonly the case. It thus appears that the heat of said gases is almost fully utilized for steam production, and that the steam was 40° to 50° hotter than that obtained from other generators tested. The log of the tests referred to exhibits in some instances a difference between the steam temperature and that noted by the pyrometer in the uptake, of less than 40°, and an inspection of its figures also indicates a high evaporative efficiency. The calculation, made by Professor Thurston of the Stevens Institute, from the log of the tests furnished him and made by the experts appointed by the Centennial judges, shows that, for each lb. of combustible consumed, 11.737 lbs. of water were evaporated at 212°.

The engravings given herewith represent a sectional view, Fig. 1, and a perspective view, Fig. 2, of the boiler. In the latter illustration, portions are broken away so as to exhibit the interior. At A are the two horizontal mud drums; at B two drums, each half filled with water and steam, the water line being in the center; and at C is a steam drum. The mud drums and the steam and water compartments are connected by a number of heating tubes, D, arranged obliquely. The grate is located between the two mud drums. The fire bridge wall, E, divides the interior of the brickwork into two compartments, while the inclined walls, F, Fig. 1, placed at a suitable distance from the heating tubes in the rear compartment, divide this into two side passages with an interior air chamber. Thus the gases of combustion are compelled to take a course from the fire box upwards over the bridge wall and downward in the two rear channels,

whence they escape to the chimney by the duct, G. The mud drums vary from 12 to 28 inches, and the upper drums from 20 to 40 inches, in diameter, and in length from 4 to 18 feet, according to the capacity of the boiler. The heating tubes are from 2 to 5 inches in diameter, and from 3 to 16 feet long. They are arranged in two or three rows and are expanded in the mud and upper drums. The masonry consists of plain brick walls lined in the inner side with fire brick. All the drums are provided with large manholes, which admit of ready examination of the whole interior of the boiler and easy cleaning and the removal of sediment. By holding a light in each heating tube from the inside of the mud drums, and examining them from the upper drums, their condition can be at once ascertained; and by striking them lightly upon the outside, the deposits, if any, we are informed, may be quickly removed. There are no heating tubes placed horizontally or nearly so in the boiler, so that no resting place is afforded for soot and ashes, nor for sediments, to accumulate to cause the burning of tubes or destructive explosions.

To the rear and entirely outside of the boiler are two 4-inch circulating pipes, through which the water is constantly passing, causing a continuous circulation of water in the generator.

The water is forced into the mud drums, and the inventors claim that, as it is heated, the impurities fall to the bottom of the drums, whence they can be easily removed. It is further claimed that nearly every particle of carbon in the fuel is consumed, and that the flame is actually brighter at the top of the furnace than at the bottom. This is partly due to the introduction of heated air from the rear or air chamber into the fire box, through the downwardly inclined passages shown in the fire bridge wall, which furnishes a proper supply of oxygen of a temperature of about 800° or more. The ignition of all the unburnt carbon contained in the gases of combustion is thus produced. The supply of this heated air is regulated by a damper in the rear wall, controlling the ingress of cold air to the said rear chamber. Any description of fuel can be burned, including tan bark, sawdust, slack, etc. For the heating of dwellings and public houses, for power purposes on small vessels and in oil regions, the boilers are made portable, from 2 horse power upward. The general advantages claimed may be

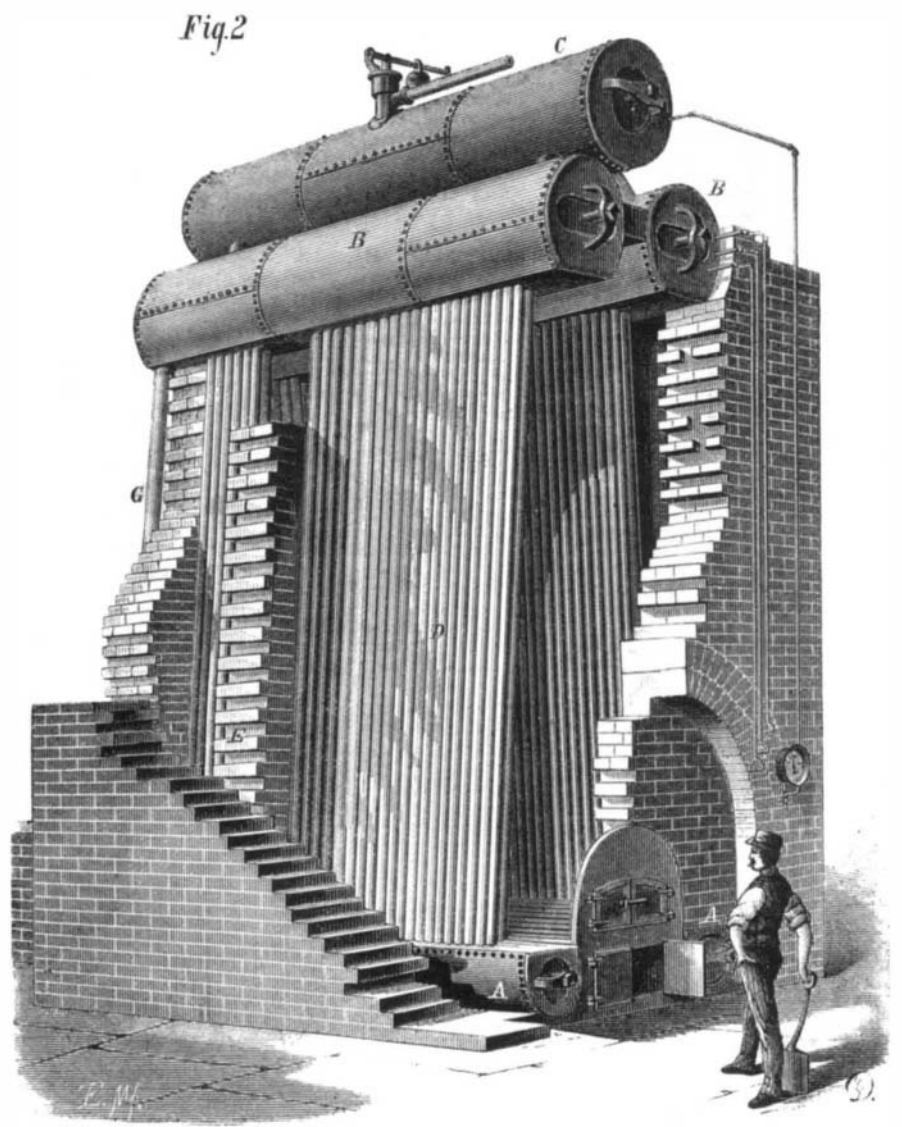
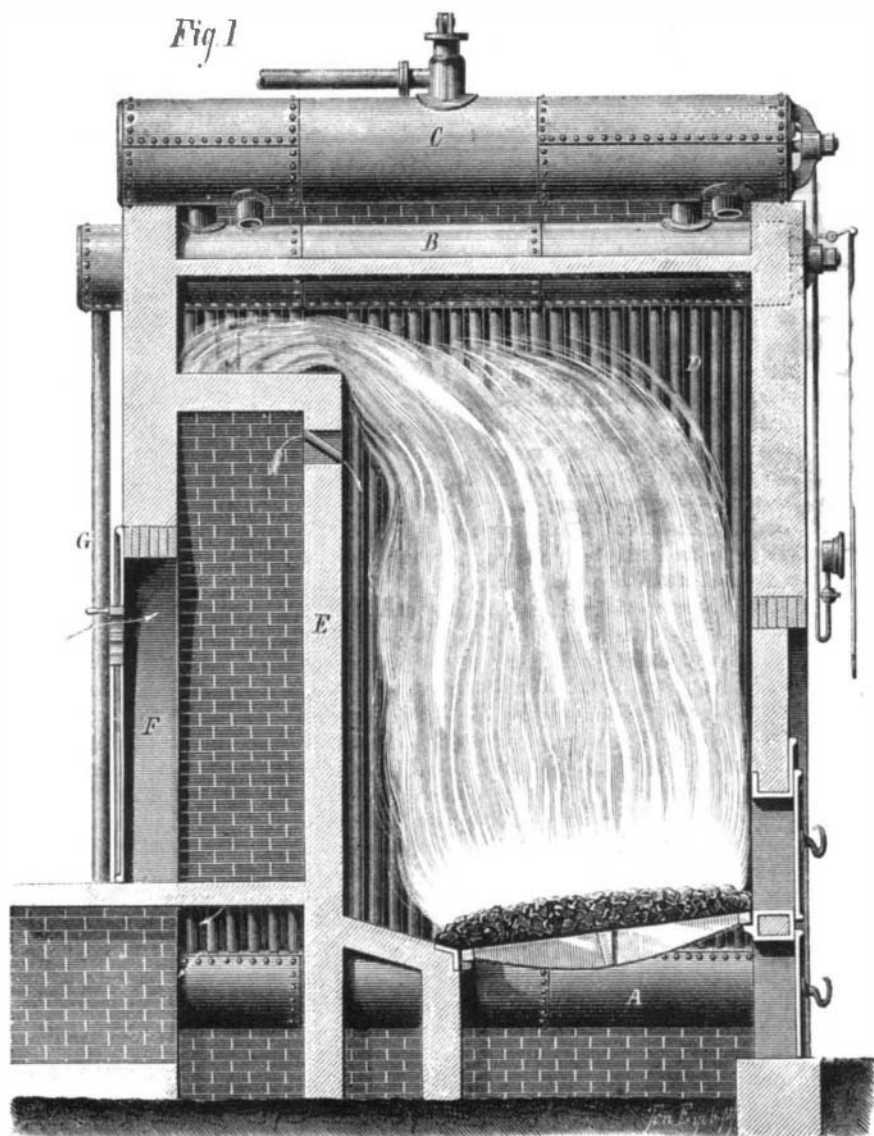
summed up as follows: Safety from destructive explosions, durability, no cleaning of flues, no deposit of soot or ashes, easy access to all parts, no leakage from unequal expansion, saving in first cost, entirely dry steam, and every facility for removing injured parts for repairs, etc. One of these boilers supplied steam for driving part of the machinery at the Centennial Exposition, and received a medal of award and a log by experts as already stated, showing it to be more economical and productive of dryer and hotter steam by 40° than other boilers tested. A generator of this type, rated at 160 horse power, has been in use, we are informed, for over three years night and day, under a pressure of from 90 to 100 lbs. of steam, without any external cleaning or repairs. The manufacturers have complete tables and calculations prepared by Professor Thurston from the log above alluded to, copies of which they will furnish upon application.

Patented July 5, 1875, November 16, 1875, and January 6, 1876. For further particulars or regarding agencies throughout the United States, address the manufacturers and patentees, Messrs. Joseph & George Firmenich, 13 to 23 Mortimer street, Buffalo, N. Y.

Blue Lamp Chimneys.

Noted oculists, for instance Gräft, Arlt, and Stellwag-Carion, recommend either blue, bluish gray, or smoke-colored glasses as a protection for weak eyes against the unpleasant effect of red, orange, and yellow light. On the same principle, the trying reddish yellow light of candles, lamps, and gas, on normal eyes as well as weak ones, can be pleasantly modified by the use of blue chimneys or globes (or at least of shades for the reflection of the light) colored a light ultramarine blue. A remarkably near approach to a light as agreeable as daylight is said to be produced by a petroleum lamp with a round wick and a light blue chimney of twice the usual length, the latter causing so great a draught that the petroleum burns with a nearly pure white flame.

THE distance apart of the rivets used to connect two pieces of metal plate together is regulated by the rule that the joint sectional area of the rivets shall be equal to the sectional area of plate left after punching the rivet holes.—*Rankine.*



FIRMENICH'S WROUGHT IRON TUBULAR SAFETY BOILER.