

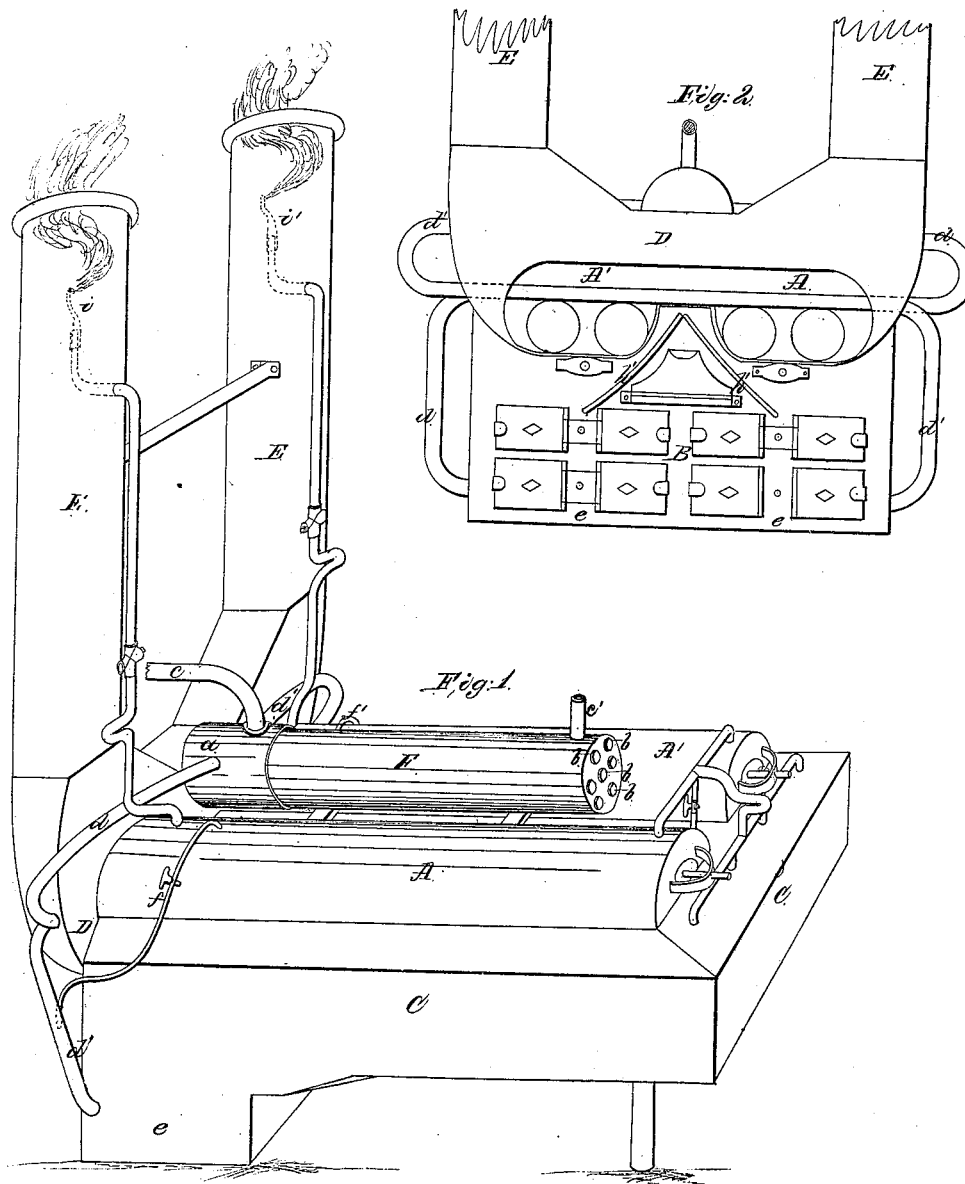
B. Cranford,

2 Sheets, Sheet 1.

Steam-Boiler Furnace.

N^o 7,051.

Patented Jan. 29, 1850.

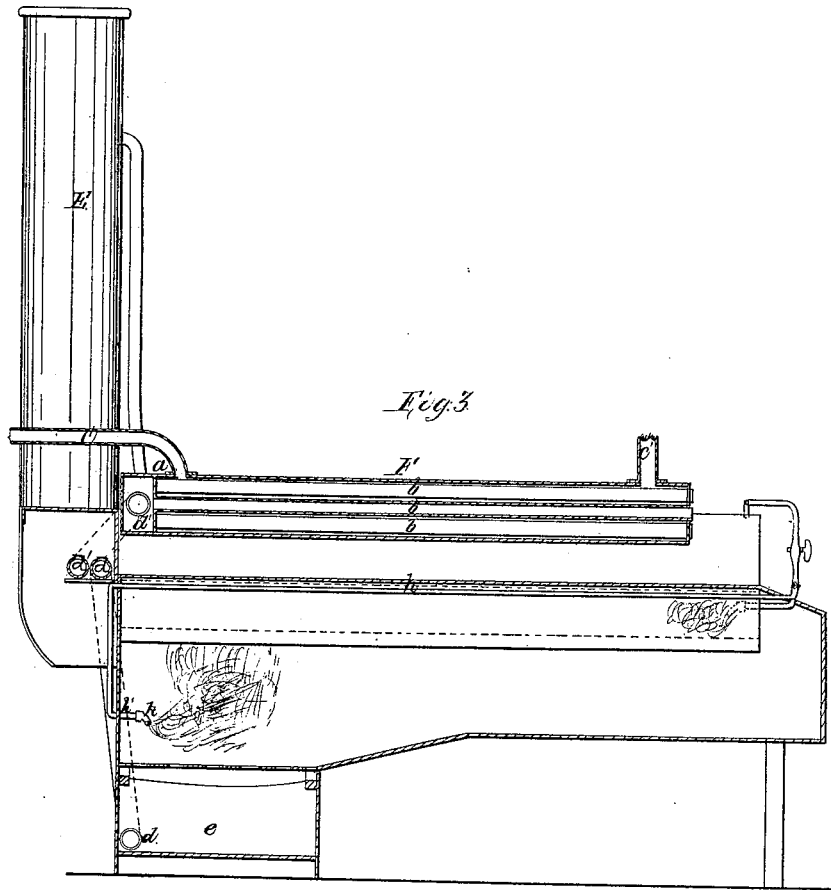


B. Crawford, 2 Sheets, Sheet 2.

Steam-Boiler Furnace.

N^o 7051.

Patented Jan. 29, 1850.



UNITED STATES PATENT OFFICE.

BENJAMIN CRAWFORD, OF ALLEGHENY, PENNSYLVANIA, ASSIGNOR TO CRAWFORD, ENGLISH, BENNETT, AND FRISBY.

STEAM-BOILER FURNACE.

Specification forming part of Letters Patent No. 7,051, dated January 29, 1850; Reissued December 2, 1862, No. 135.

To all whom it may concern:

Be it known that I, BENJAMIN CRAWFORD, of the city and county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Air-Heaters and Steam-Blowers for Steam-Boilers, of which the following is a full, clear, and exact description, reference being made to the accompanying drawing, forming part of this specification, in which—

Figure 1 is a perspective view of a pair of flue boilers fitted with my improvements; Fig. 2 is a front elevation, and Fig. 3 is a vertical longitudinal section through the center of the same.

The nature of my invention consists; first, in heating the air required for the combustion of the fuel by the waste steam of the engine and the waste heat from the boiler flues, and then forcing it through the ash pit into the fire by jets of steam which are mingled with the heated air and likewise pass into the fire; second, in the employment of self revolving adjutages to discharge heated steam among the gases above the fuel in the grate, to coöperate with the hot air and steam forced through the ash pit in producing a perfect combustion, while the draft is maintained by jets of steam discharged through self revolving adjutages in the smoke pipes and flues.

In the drawing, A, A', are two flue boilers with their fire chamber B, casing C, flue heads D, and smoke pipes E, E. Above the boilers I place a cylindrical or other shaped vessel F, into one end *a*, of which, the exhaust steam from the engine is introduced by a pipe *c*; the vessel is traversed from end to end by tubes *b*, *b*, *b*, between which the steam passes, and such portions as escape condensation are discharged through a pipe *c'*, at the end of the vessel opposite to that at which it was admitted. The tubes are all connected at their front ends with a pipe which branches outward from the vessel in opposite directions; each branch *d*, *d'*, proceeds outward and downward until it is clear of the flue heads, it is then returned and, extending through the whole breadth of the flue heads, passes out through the side opposite to that through which it entered; it is now again bent downward and returned into the ash pit *e*, beneath the grate bars.

The arrangement of pipes thus described constitutes the heater by which the air required for the combustion is heated to a high temperature previous to its action upon the fuel; the cold air enters the hinder ends of the tubes *b*, *b*, *b*, and proceeding through them absorbs the heat from the waste steam by which they are surrounded to such a degree that much of the steam is condensed. Thence passing through the pipes *d*, *d'*, it abstracts an additional quantity of heat from the spent flame in the flue heads D, and enters the closed ash pit in a highly heated state; as the draft alone would be insufficient to draw the requisite quantity of air through the heater, the velocity of the current in the air pipes *d*, *d'*, is increased by jets of steam discharged through the air pipes toward the ash pit at or near their lower extremities; the steam for this purpose is brought directly from the boiler through small pipes *f*, *f'*, which enter the air pipes and proceed in the same direction with them toward the ash pit. The jets of steam thus introduced increase the current of air in the pipes *d*, *d'*, and draw a sufficient quantity through the heater to produce a rapid combustion of the fuel on the grate.

In order to complete the combustion of the gases arising from the fuel burning on the grate, I inject among them steam heated to the proper temperature by passing it longitudinally through pipes *h* placed in the upper angles of the roof of the direct flues between the boilers; these pipes pass through the front wall of the furnaces, where they are divided into several branches *h'*, *h'*, which proceed downward against the outer face of the front wall until they are at the proper distance above the grate, when they are turned inward and pass through the front wall into the furnace; the extremity of each branch is furnished with a self revolving adjutage *k* (hereinafter described) by which the intensely heated steam is distributed among the gases evolved from the burning fuel.

As the heat of the spent flame in the flue heads is absorbed to a great extent by the air in the pipes the draft of the smoke pipes is insufficient to draw the flame from the furnaces through the flues; this difficulty is

obviated by the use of steam jets discharged through self revolving adjutages *i, i'*, of the same form as those used for supplying heated steam above the grate. Each adjutage is formed of a short pipe one end of which is straight and is fitted upon the open extremity of the steam pipe; the other extremity is twisted, and the steam is discharged therefrom in a direction oblique to both the axis and radii of the steam pipe thus giving by the reaction of its effluent force a whirling motion to the adjutage, which in turn imparts a similar motion to the issuing steam.

The whirling motion given to the heated steam discharged above the fuel mingles it thoroughly with the combustible gases and completes their combustion, while at the same time the air in passing through the tubes *b*, and pipes *d, d'*, absorbs the heat from the exhaust steam and spent flame, and prevents the loss of heat that would otherwise take place. The whirling motion produced in the smoke pipes produces an equable current throughout their whole cross section and produces a much greater draft with the same expenditure of steam than could be

obtained by allowing the steam to issue vertically upward in the smoke pipes.

Having thus described the several improvements I have made in the construction and arrangement of my steam boiler furnace and the steam blower therefor for the purpose of economizing fuel by rendering its combustion more perfect, and by reclaiming a portion of the waste heat of the flues and exhaust steam; what I claim therein as new and desire to secure by Letters Patent is—

The injection of whirling jets of highly heated steam among the gases evolved by the fuel on the grate simultaneously with the forcing by the steam blower of a stream of mingled steam and heated air through the ash pit into the fire; the air being heated substantially in the manner described by the exhaust steam and waste heat of the flues, and the draft of the flues being maintained by whirling jets of steam injected by the steam blower.

BENJN. CRAWFORD.

Witnesses:

P. H. WATSON,
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