(No Model.)

E. D. FERRIS & G. M. WHEELER.

AUTOMATIC WATER CIRCULATING FIRE GRATE.

No. 517,567. Patented Apr. 3, 1894.

Fig. 1.

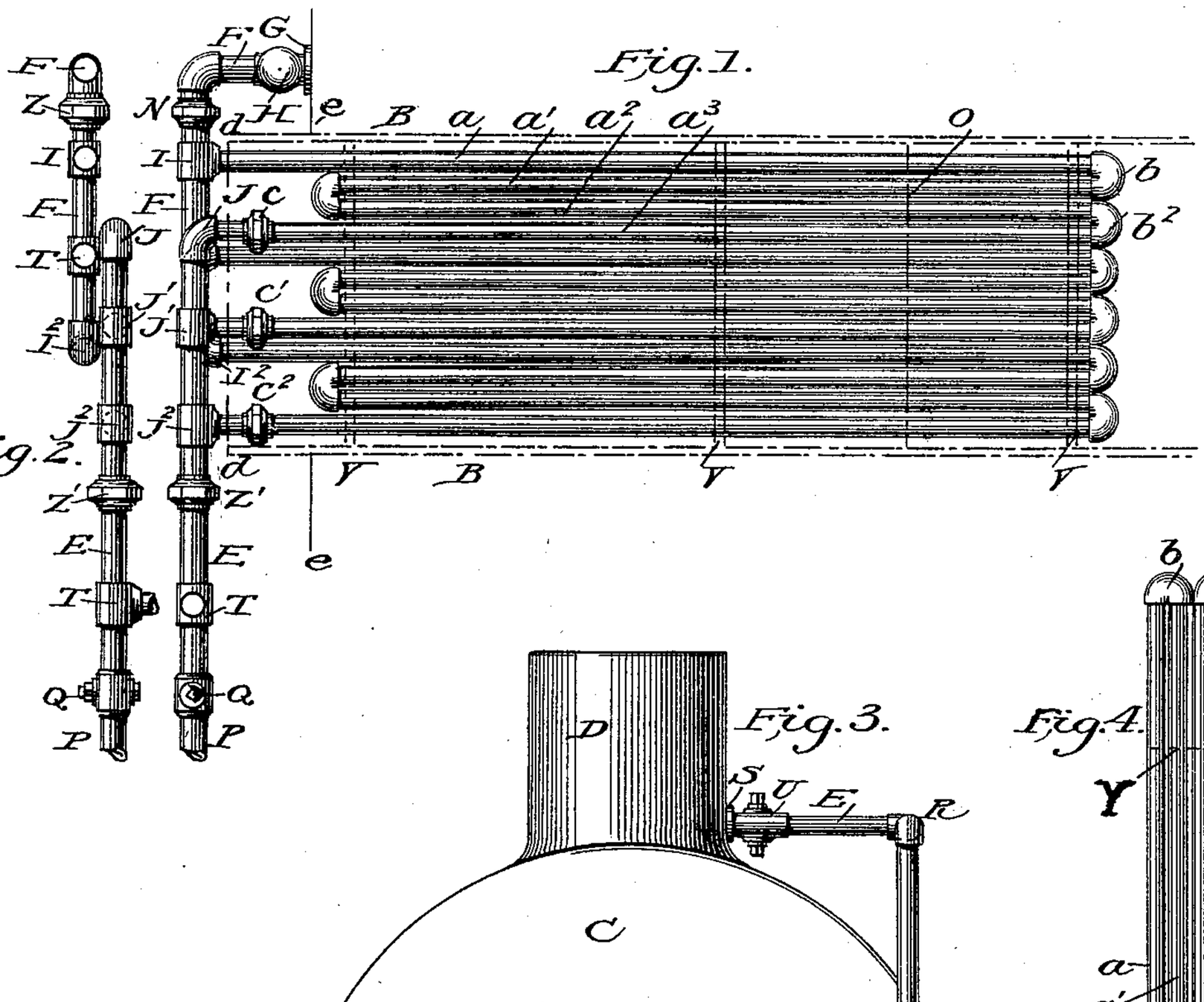

Fig. 2.

Fig. 3.

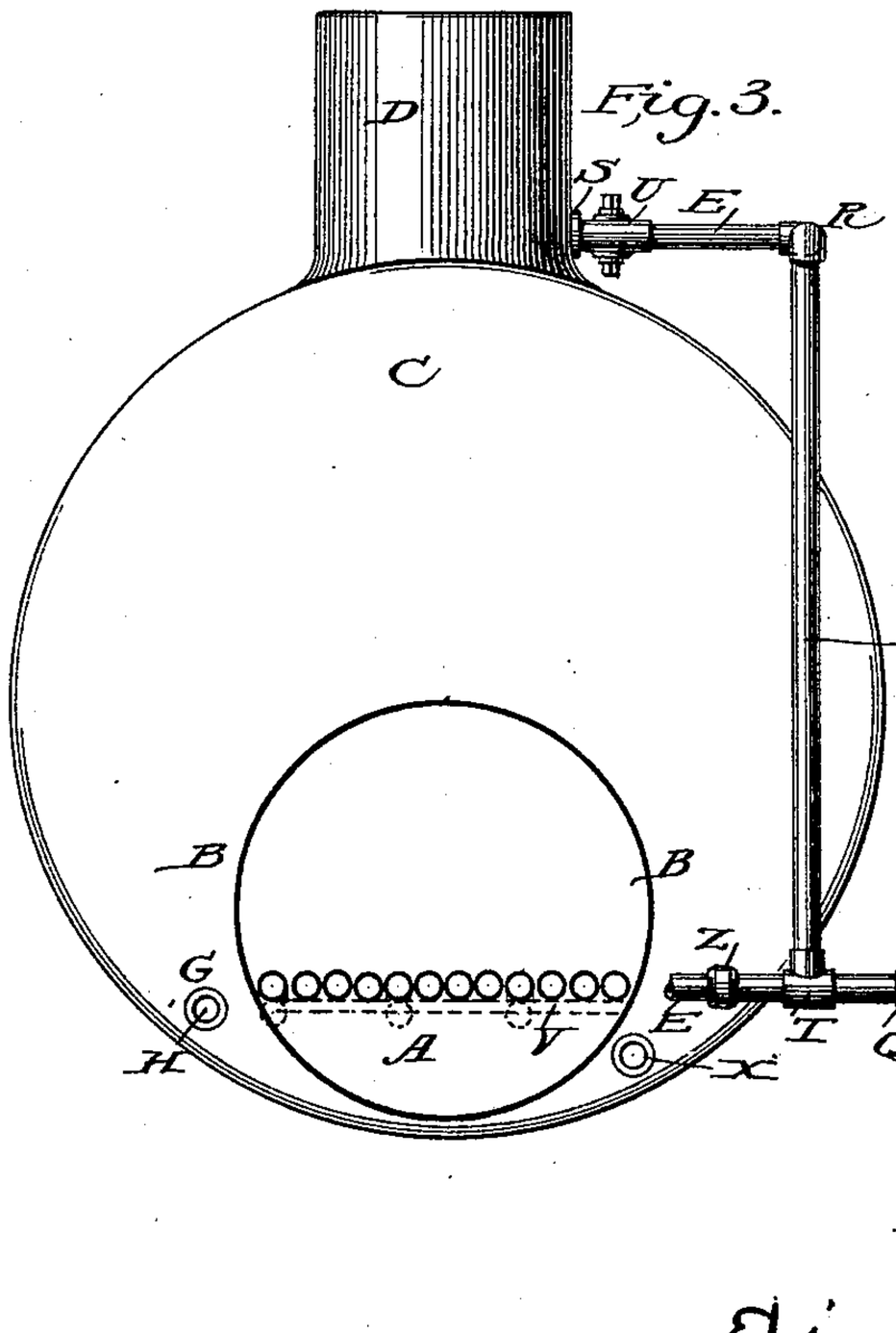

Fig. 4.

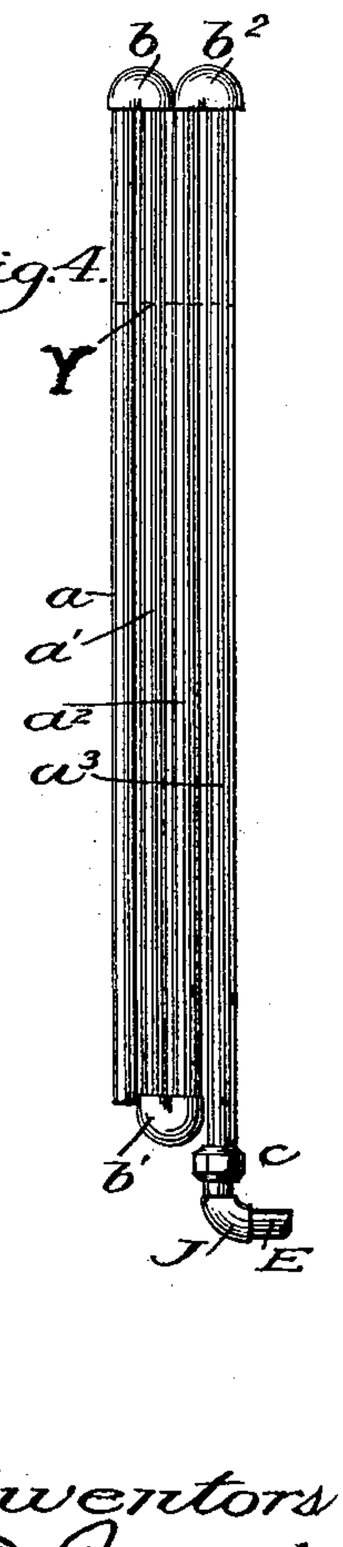

Fig. 5.

Witnesses.

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EDWIN DALEY FERRIS AND GAGE M. WHEELER, OF TACOMA, WASHINGTON.

AUTOMATIC WATER-CIRCULATING FIRE-GRATE.

SPECIFICATION forming part of Letters Patent No. 517,567, dated April 3, 1894.

Application filed February 20, 1893. Serial No. 463,138. (No model.)

To all whom it may concern:

Be it known that we, EDWIN DALEY FERRIS and GAGE M. WHEELER, citizens of the United States, residing at Tacoma, in the county of Pierce and State of Washington, have invented a new and useful Tubular Fire-Grate, of which the following is a specification.

Our invention relates to improvements in automatic water circulating fire grates in which tubular grate bars, of proper dimensions and nearness, to form a proper grate, properly connected at the ends, by suitable tubular return bends; in conjunction with suitable feed, and escape pipes, and the objects of our improvement are: first, to provide a fire-grate that, under ordinary or constant use will possess the greatest durability; second, to produce a fire-grate that, in the use of coal and other similar fuel, will keep free from clinkers; third, to afford facilities for the production of a greater amount of steam, with the same or a less quantity of fuel; fourth, to afford facilities for a free and automatic circulation of water, from the boiler in which the grate may be used, through the tubular grate bars and returning to the boiler in the form of super-heated water or steam; fifth, to afford facilities for equalizing the temperature of the water in the boiler; and preventing the unequal expansion of the several parts of the boiler. We attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1, represents a plan view of our improved tubular fire grate. Fig. 2, represents an end view of the tubular fire grate, properly showing the relative positions of the feed and discharge pipes. Fig. 3, represents an elevation of the front of a "Scotch marine boiler" and section of the grate. Fig. 4, represents a section composed of four adjacent grate bars and return bends for connecting the same, together with connections to the discharge pipe, showing also the method of construction. Fig. 5, represents the method of connecting the feed pipe with the grate bar.

In the accompanying drawings, A represents the ash pit, B B, the wall or sides of the flue, or furnace of a Scotch marine boiler, C the boiler, D, the dome.

e e represent the end of the boiler.

d d represent the outer line of the flue B B.

The feed pipe F, is connected with the boiler C, at G, and is provided with a stop cock or plug valve H, and is connected with the several sections of the grate at I, I′ I², by the connections K.

O, represents the grate, Fig. 1, and Y a section of the grate, Fig. 4.

X represents feed to boiler.

The discharge pipe E, is connected to the several sections of the grate at J, J′, J², and is furnished with a "T joint" at T, and a right projection P, with a stop cock Q, said discharge pipe projects upward from T to R, when it bends backward by a right angle to a point opposite the dome D, where said pipe is connected by a square turn to the dome D, at S, and is provided with a stop cock U.

V, V′, V², represent truss bars supporting the grate.

The fire-grate is constructed in sections, connected together as in Fig. 1, each section is constructed as shown in Fig. 4, and is provided with four tubular grate bars *a*, *a′*, *a²*, *a³*, of proper dimensions, each end of the grate bars *a*, *a′*, *a²*, *a³*, is threaded so as to be screwed into the threaded tubular return bends *b*, *b′*, *b²*, and into the tubular connections, with the feed pipe F, and the discharge pipe E. The bars "*a*" and "*a³*," are made longer than "*a′*" and "*a²*," as shown in Figs. 1, and 4. Said section is put together and connected in the grate as follows: Tube "*a*," with its projection K, as shown in Fig. 5, is screwed into feed pipe F, at I. Return bend *b*, is then screwed onto "*a*." Then "*a′*," is screwed into "*b*," then "*b′*" onto "*a′*," then *a²*, into *b′*, then *b²*, onto *a²*, then *a³*, into *b²*, which completes the section, and likewise with each section until the grate is of the required width. Then the discharge pipe E, is connected to the several sections by the unions, *c*, *c′*, *c²*, as shown in Figs. 1 and 4.

It will be observed by noticing Figs. 1 and 2, that the feed pipe F, projects under discharge pipe E, and the connections or extensions of the tubes connecting therewith bend downward.

When the grate is completed and ready to place in the furnace and attach to the boiler, we do that by disjointing the feed pipe F, at the union Z, and disjointing the discharge pipe E, at the union Z′, then place the grate

upon the truss bars V, V′ and V², as any ordinary grate. Then the disjointed end of feed pipe F, by the necessary turns and bends, is secured to the boiler at G, by a flanged plug valve H. Then we unite the feed pipe F, by the union Z. Then the disjointed end of discharge pipe E, with the necessary turns and bends is connected to the dome D, at S, by the flanged plug valve or stop cock U. Then we unite the discharge pipe E, by the union Z′. Then into the T joint at T an ordinary nipple is screwed into which is screwed the plug valve Q, into which is screwed whatever length of pipe may be desired, to form the blow off pipe P.

In the construction of this grate we use the best steel pipe, using a larger pipe for the feed, and discharge pipes, than for the grate bars using for connections with the grate bars reduced T's and reduced L's. Though such materials may be used and such methods of construction adopted as the builder might desire.

Having the grate in position and connected, we open valve H, whence the water from the boiler passes through the feed pipe F, into each of the several sections, simultaneously, and passes backward and forward through tubes "*a*," and turns "*b*," into the discharge pipe E, at the several connections and through the discharge pipe E, into the dome D, but the water will rarely, if ever, reach the dome D, it being converted into steam, while in the pipes, and steam only will reach the dome. When the fire is built in the furnace and the water begins to heat in the tubes, it is better, though not necessary to close valve U, and open valve Q, and let the sediment that may settle in the tubes, and the water in the pipe E, blow out through the pipe P, to insure free circulation of the water in the tubes, and the unobstructed escape of the steam through the pipe E, into the dome D. When we think the water and sediment are sufficiently blown out we close valve Q and open valve U, when automatic circulation will begin and continue so long as the fire is kept up without any further attention from the engineer or fireman.

Our grate may be used on any boiler, and built to any size, observing always that the feed pipe F, should be connected to the boiler at the lowest practicable point and the discharge pipe E, above water level in boiler, also observing that the size of the desired grate determines the size of the pipe to be used, and the size and number of the sections. We keep our grate tubes at a low temperature to prevent the formation of clinkers, and the burning out of the grate bars, by making the sections small, so as to allow the steam and super-heated water, to escape, as soon as steam is formed, at every fourth tube from the feed, in our drawings, as shown in Figs. 1 and 4, when the water travels about fourteen feet, before being entirely converted into steam.

We produce the greatest amount of steam with the least amount of fuel, and obtain the freest circulation, by allowing the steam to escape to the boiler through the pipe E, as fast as it is generated in the tubes, as shown at every fourth tube from the feed in Figs. 1 and 4.

We connect our feed pipe to the boiler at the lowest practical point so as to draw off the coldest water in the boiler to allow hot water from the upper part of boiler to flow to lower part, and thereby raise the temperature of the lower part and cause an equal expansion of all parts of the boiler.

It will be readily observed that it would be impractical to use large tubes for grate bars. It will also be observed that water will not travel very far in a hot tube till it becomes converted into steam and that length of tube through which steam travels would become as hot as an ordinary grate bar, where water or steam is not used, for that steam reaches a very high temperature, therefore it is necessary to construct the grate in sections so that the steam can pass off as rapidly as generated.

If a furnace should be very large and long it might be necessary to have the discharge pipe at the back end of the grate because the water could not make the circuit in a long grate through an ordinary tube.

It will be observed that our grate does not diminish the contents of the boiler, water leaves the boiler at one side and returns in the form of steam at the other. The only attention the engineer need give is to blow it off now and then, to satisfy himself that the circulation is free. It does not interfere with the feed of the boiler, the boiler being fed from another pipe at X, in the ordinary way.

When it becomes necessary to repair our grate or to remove it for any cause we close the valves H and U, open valve Q, to let off the water in the tubes if any, disjoint it at the unions Z and Z′ when the grate may be slipped out.

Through the citations furnished us, we are informed that tubular fire grates, have been patented prior to our application, and therefore we do not claim a tubular fire grate broadly. But

What we do claim as our invention, and desire to secure by Letters Patent, is—

1. The combination, in a tubular fire grate, of a tubular fire grate having sections, Y; with a feed pipe F, having a stop cock H, and a union Z and connections I, I′, I², and K connected to the boiler C; with a discharge pipe E, having connections J, J′, J², and a union Z′ and a stop cock U, connected to the dome or upper part of a boiler or dome D; with a blow off pipe P, having a stop cock Q, connected to pipe E, all substantially as set forth.

2. The combination in a tubular fire grate, of a tubular section Y, having tubular bars and tubular return bends, and connection K and unions *c;* with other like tubular sections Y, each adjustable to the feed pipe F,

and the discharge pipe E, independently of each other, all substantially as set forth.

3. The combination in a tubular fire grate, of a tubular section Y, having connections K, and unions *c;* with a feed pipe F, having connections I, and a union Z, and stop cock H, attached to a boiler C, with a discharge pipe E, having connections J, and union Z′, and stop cock U, and blow off pipe P, all substantially as set forth.

4. The combination in a tubular fire grate, of a feed pipe F, having a flanged plug valve or stop cock H, a union Z and connections I, I′, I², adjustable to a boiler C, and a grate section Y, with a tubular fire grate O, having sections Y; with a discharge pipe E, having connections J, and union Z′, and stop cock U, and a blow off pipe P, having stop cock Q, all substantially as set forth.

5. The combination in a tubular fire grate, of a discharge pipe E having connections J, a union Z′, a stop cock or flanged plug valve U, and a blow off pipe P, adjustable to the boiler, as at dome D, and to the grate at J, with a tubular grate O, having sections Y, with a feed pipe F, having connections I and union Z, and valve H, all substantially as set forth.

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