Aug. 16, 1932. T. E. MURRAY 1,872,167

BOILER

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Fig. 1.

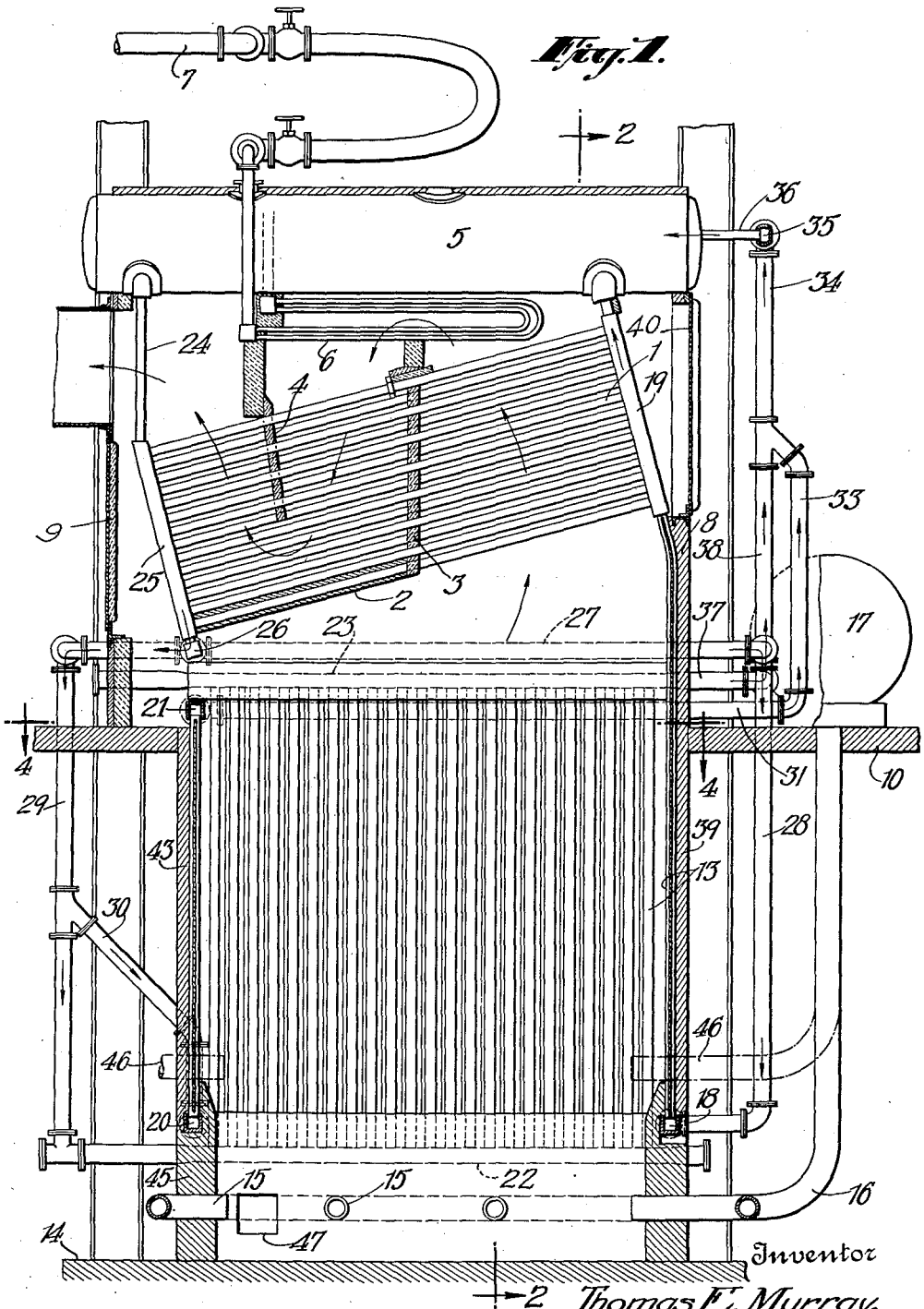

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Fig. 2.

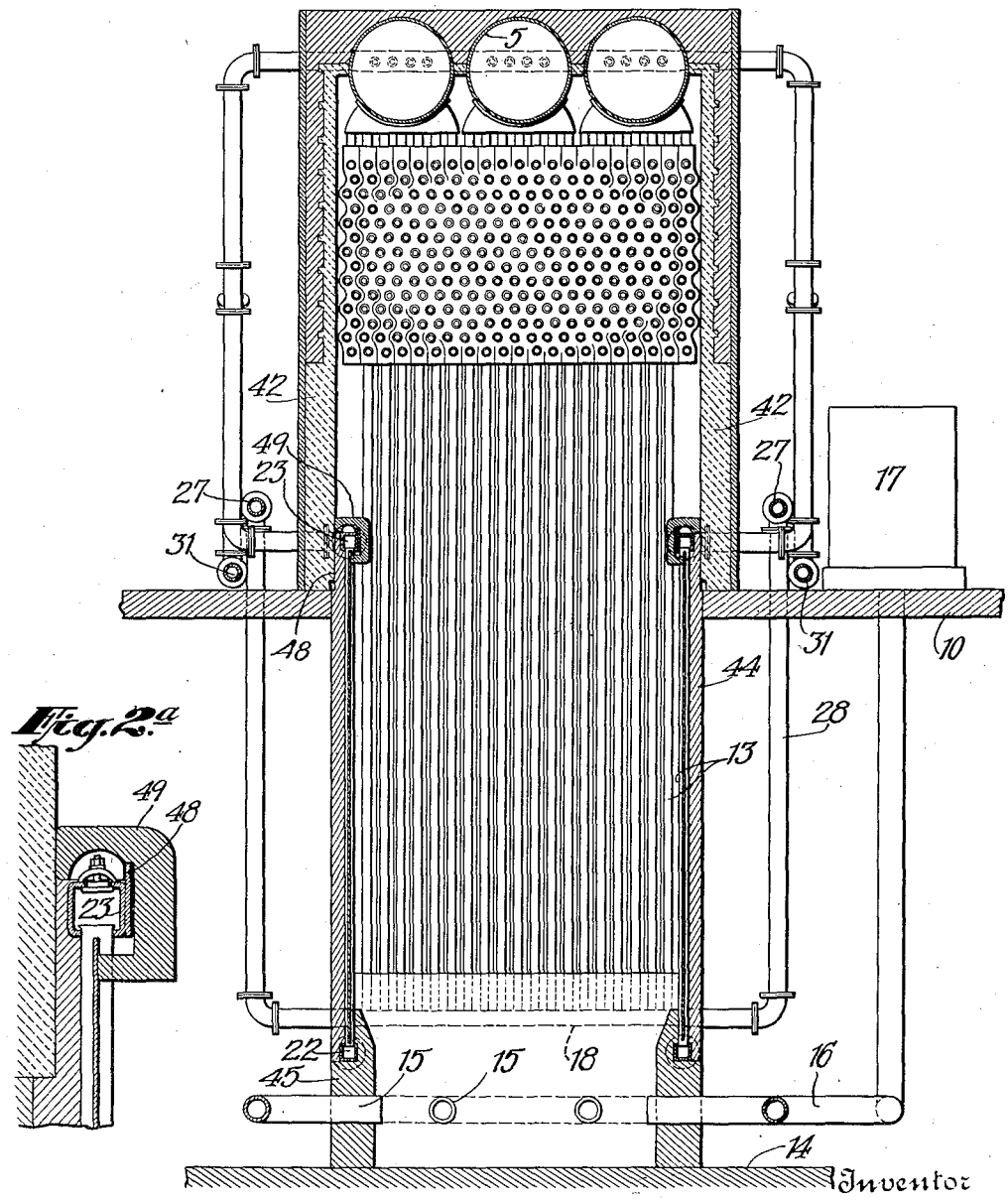

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Fig. 3.

Before Conversion to Coal Dust Firing

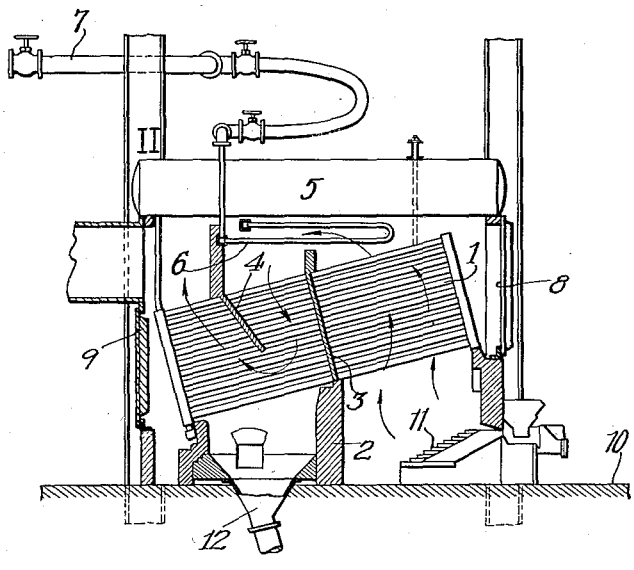
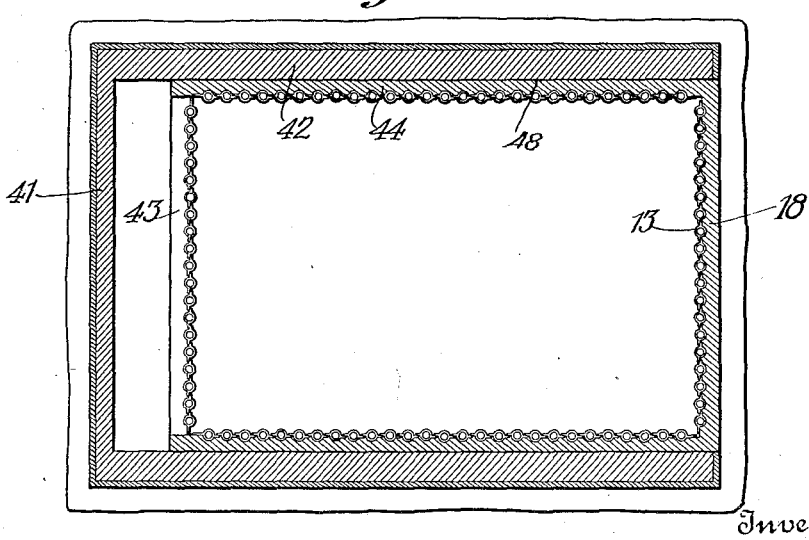


Fig. 4



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UNITED STATES PATENT OFFICE

THOMAS E. MURRAY, OF BROOKLYN, NEW YORK; JOSEPH BRADLEY MURRAY, THOMAS E. MURRAY, JR., AND JOHN F. MURRAY, EXECUTORS OF SAID THOMAS E. MURRAY, DECEASED, ASSIGNORS TO METROPOLITAN ENGINEERING COMPANY, A CORPORATION OF NEW YORK

BOILER

Application filed February 2, 1926. Serial No. 85,439.

My invention aims to provide an advantageous method of changing a boiler of the grate fired type to adapt it to the use of pulverized coal or similar jet fuel; and to provide various improvements in boilers as described in detail hereinafter.

The accompanying drawings illustrate an embodiment of the invention.

Fig. 1 is a longitudinal section of a boiler arranged to be heated by pulverized coal;

Fig. 2 is a cross-section of the same on the line 2—2 of Fig. 1;

Fig. 2^a is an enlarged detail thereof;

Fig. 3 is a longitudinal section of a boiler heated by a grate fire before conversion into the coal dust fired type;

Fig. 4 is a section on the lines 4—4 of Fig. 1.

The introduction of coal dust firing into the boiler industry has made it possible to secure very much higher capacities and temperatures. But the mere substitution of nozzle burners for the old grates and stokers has left the unit unbalanced, the old tubing being inadequate to utilize to the best efficiency the heat supplied by the burners.

I propose to utilize the space left by the removal of the grates and stokers by providing the combustion chamber with a lining or wall of additional tubes and by injecting the burning fuel into the space within these tubes; so that the latter are exposed to the radiant heat of the burning fuel and so that the products of combustion pass on to the approximately horizontal tubes of the original boiler. By this arrangement the higher temperatures available are most efficiently utilized in the lower part of the boiler, and the remaining heat units are further utilized in the upper part. In this way, the boiler power in a unit of the original size may be increased one hundred per cent or more. At the same time, the parts may be so proportioned as to maintain a lower temperature on the brick work about the upper tubing than when the boiler was grate fired.

Fig. 3 illustrates a boiler of the old type with approximately horizontal boiler tubes 1, a bridge wall 2 and baffles 3 and 4, above which are steam drums 5 and a superheater 6 leading to the steam main 7. The boiler is enclosed in walls 8 and 9 above the floor line 10. A stoker is indicated at 11 and a hopper at 12 for carrying away the cinders. This hopper and other parts extend below the floor line to a substantial distance.

I propose in changing over to coal dust firing, to remove the grate and hopper and the usual stoking apparatus and the bridge wall 2 within the combustion chamber and to add the equipment shown in Figs. 1 and 2. Below the horizontal tubing I arrange a series of vertical tubes 13, preferably on all four sides of the space and extending down nearly to a lower floor or other support 14, and in the intervening space, I provide nozzle burners 15 receiving coal dust, or a mixture of coal dust and air through a pipe 16 coming from a supply tank or pulverizer 17. The tubes 13 may be spaced apart with overlapping flanges in the intervening spaces (Fig. 4) as described in detail in certain previous applications which I have filed, or they may be of various other designs and arrangements.

The tubes at the front have a lower header 18 and extend at their upper ends into the vertical headers 19 of the horizontal system. The tubes at the back have lower headers 20 and upper headers 21. At the sides (Fig. 2) the tubes have similar lower headers 22 and upper headers 23.

The circulating system is as follows: The water from the drum 5 returns down through the pipes 24 and the lower headers 25 of the horizontal tubes to a cross drum 26 which communicates at its ends with pipes 27 (Fig. 2) at opposite sides of the structure; which communicate with pipes 28 extending downward and connected at their lower ends to the opposite ends of the front lower header 18. The pipes 27 extend also to the rear. One of them is illustrated in Fig. 1, connected at its rear end to a downward pipe 29 which at its lower end communicates with the rear end of the corresponding lower side header 22 (the front end of this header being closed). The pipe 27 at the opposite side leads in the same way to the rear end of the opposite lower side header 22. From the pipes 29 there are branches 30 leading to the opposite ends

of the lower rear header 20. Thus the downward circulation of water leads to all the bottom headers. The upward circulation from the tube 13 of the front wall is through the headers 19 as previously explained. From the upper rear header 21, the hot water and steam pass into pipes 31 shown at opposite sides of the boiler in Fig. 2. These pipes 31 are brought to the front and communicate with upper pipes 33 leading through a pipe 34, header 35 and pipes 36 to the steam drums. The headers 23 are closed at their rear ends (Fig. 1). Their forward ends project as at 37 and lead by pipes 38 to the pipes 34 and thence to the steam drums. I have illustrated the installation with three small steam drums instead of one large one, but this is no part of the present invention, and it will be understood that a single drum may be used.

The tubes 13 are backed by refractory and preferably insulating material constituting the outer wall or shell. The front wall 39 extends continuously upward forming the front of both the lower and the upper sections of the boiler, being interrupted in the plane of section in Fig. 1 to show the removable plate or door 40. The rear and sides of the upper section are enclosed by walls 41 and 42 (Fig. 4) of the usual or suitable construction.

These side and rear walls rest on the upper floor 10. The rear wall 43 of the lower section extends up to the level of the floor 10. The side walls 44 of the lower section extend up and within the side walls 42 of the upper section. A brick supporting wall 45 is arranged to carry the walls of the lower section. Preferably, this supporting wall encloses the lower headers as shown and extends upward a slight distance on the inner side of the tubes 13 to protect the latter from the extreme heat and also to avoid cooling of the flame before complete combustion. The pipe 16 from the tank or pulverizer extends around the supporting wall 45, with the nozzles projecting through this wall at suitable intervals. This line of nozzles may be supplemented by a second line of nozzles 46 at a higher elevation, or either line may be used without the other. The opening 47 in the supporting wall 45 is an access door for cleaning out the space within.

The problem of expansion and contraction is an important one. It will be observed that the lower section has its walls arranged to expand independently of those of the upper section. Fig. 4 illustrates the relation in horizontal section. There is a sliding joint 48 (Figs. 2 and 4) which permits a very wide expansion and contraction of the two parts relative to each other, each being independently supported at its lower end, one section on the lower floor 14 and the other on the upper floor 10. The tubes 13 may be tied into the surrounding refractory material so closely as to expand and contract therewith, or may be arranged to have relative movement with respect thereto. Each tube is separate to the next one so as to be capable of a certain amount of independent expansion.

A long combustion chamber is provided in the lower section of the boiler so as to utilize the radiant heat of the burning gases to the fullest extent. To protect the upper side headers 3, each of them is preferably encased in a refractory block or tile as indicated in detail in Fig. 2ª. A header 23 has welded on its outer face a plate 48, and this serves to support a refractory block 49 of approximately L-shape in cross-section which is hung from the inside of the header.

Various modifications of the embodiment of the invention described may be made by those skilled in the art without departing from the invention as defined in the following claims.

What I claim is:—

1. A boiler installation including in combination an overhead bank of water tubes slightly inclined from the horizontal with headers at their opposite ends, a floor, a casing enclosing said bank of tubes and supported in turn on said floor, a series of vertical water tubes arranged to substantially prevent the passage of the heating gases between them and to receive the full radiant heating effect of the flame, said tubes forming a combustion chamber with their upper ends above said floor and their lower ends extended downward below the floor, means for providing a circulation continuously through said inclined tubes and said vertical tubes and a common steam drum, and nozzle burners for projecting burning fuel into said combustion chamber.

2. A boiler installation including in combination an overhead bank of water tubes slightly inclined from the horizontal, with headers at their opposite ends, a floor, a casing enclosing said bank of tubes and supported above said floor, a series of vertical water tubes arranged to substantially prevent the passage of the heating gases between them and to receive the full radiant heating effect of the flame, said tubes forming walls of a combustion chamber with their upper ends above said floor and their lower ends extended downward below the floor, means for providing a circulation continuously through said inclined tubes and said vertical tubes and carrying the steam to a common outlet, and nozzle burners for projecting burning fuel into said combustion chamber.

In witness whereof, I have hereunto signed my name.

THOMAS E. MURRAY.