E. F. EDGAR.

STEAM BOILER.

APPLICATION FILED MAR. 30, 1909.

934,718.

Patented Sept. 21, 1909.

2 SHEETS—SHEET 1.

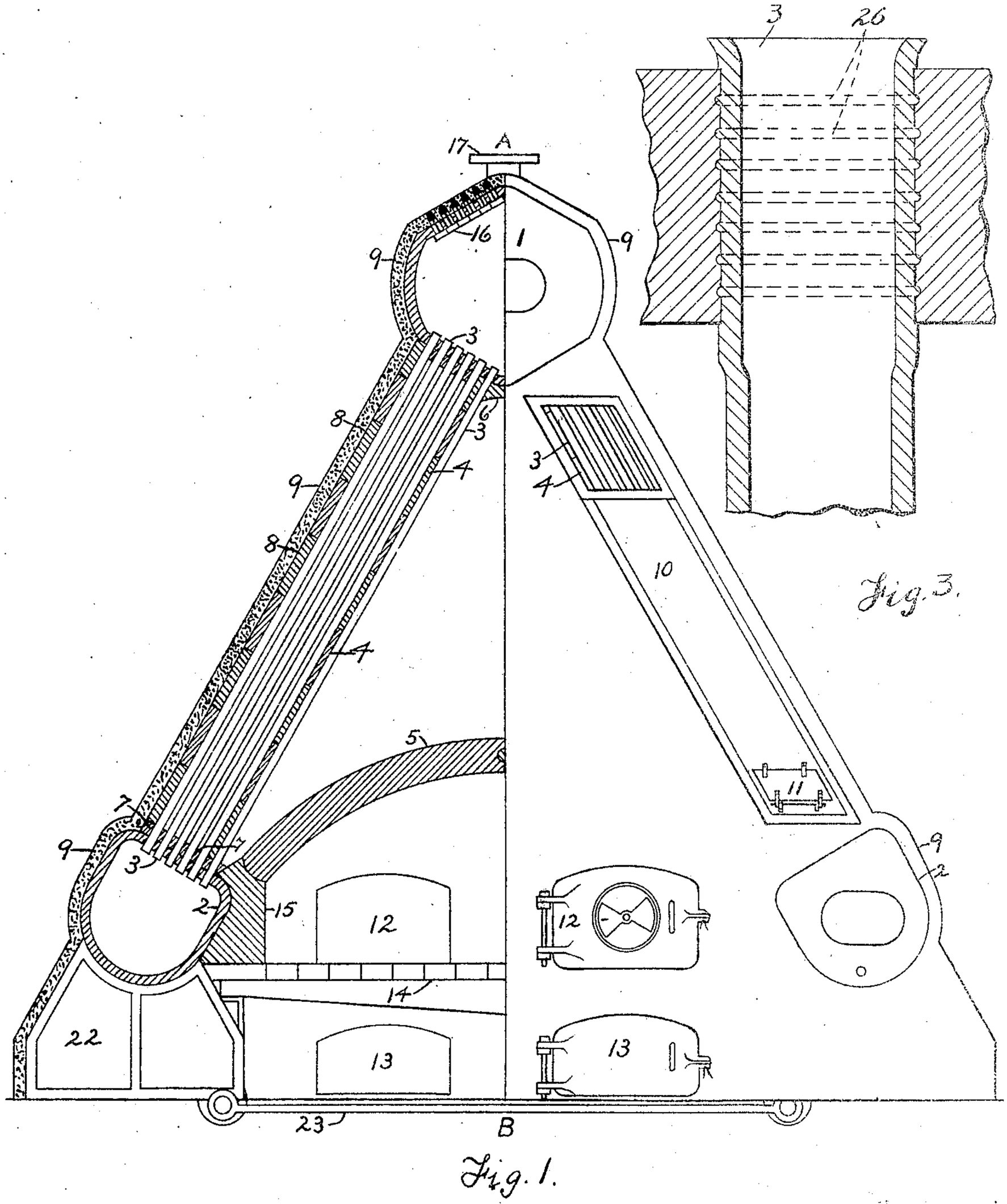

Fig. 1.

Fig. 3.

WITNESSES:

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INVENTOR

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2 SHEETS—SHEET 2.

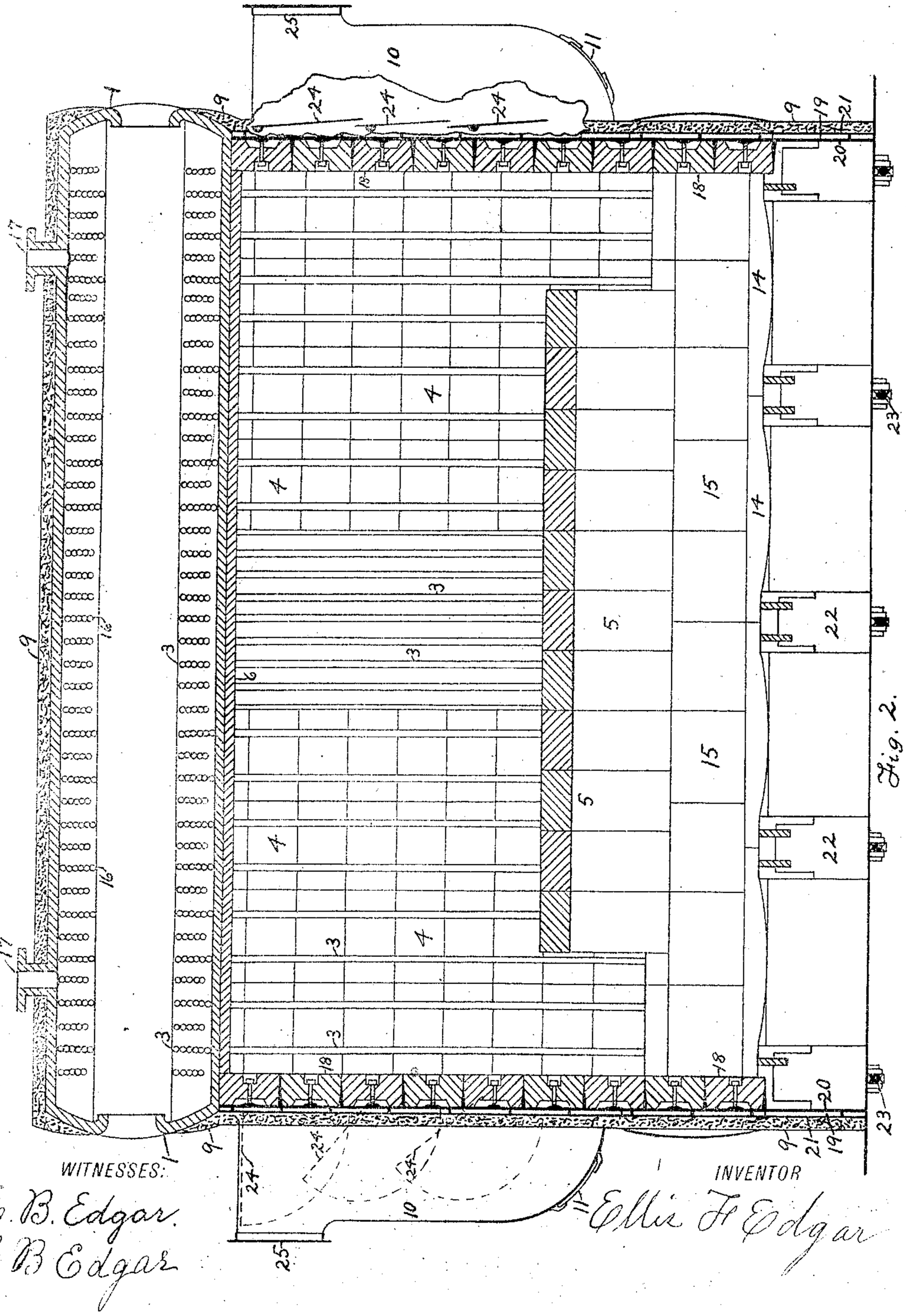

Fig. 2.

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ELLIS F. EDGAR, OF WOODBRIDGE, NEW JERSEY.

STEAM-BOILER.

934,718. Specification of Letters Patent. Patented Sept. 21, 1909.

Application filed March 30, 1909. Serial No. 486,777.

To all whom it may concern:

Be it known that I, E. F. EDGAR, citizen of the United States, and resident of Woodbridge, in the county of Middlesex and State of New Jersey, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification.

Figure 1 is a front elevation view part in full and part in section of a boiler embodying my invention. Fig. 2 is a sectional side elevation view at line A—B in Fig. 1. Fig. 3 is an enlarged detail section view of one tube expanded in sheet of upper drum.

My object in inventing this boiler is to produce a boiler capable of working at one thousand pounds pressure or more and delivering dry steam to an engine with high boiler efficiency and a boiler that will always keep water on its heating surface and capable of producing a very high furnace temperature with escaping flue gases about the temperature of the steam and a boiler of long life and little repairs. The construction and value of these features I will hereafter explain.

Details of construction.—1, water and steam drum, 2, water and mud drum, 3, water tubes, 4, baffle wall, 5, brick arch, 6, non-combustible protection on bottom of upper drum, 7, non-combustible protection of lower drum, 8, light brick covering on outside of water tubes 3, 9, asbestos outside covering, 10, uptakes, containing adjustable draft baffles clean out door and draft exit, 11, clean out door, 12, furnace door, 13, ash pit door, 14, grates, 15, arch skew back bricks, 16, holes for the withdrawal of water tubes 3, 17, steam exits, 18, lining bricks for end casing, 19, dead air space, 20, cast iron or steel casing, 21, partition between dead air space and asbestos covering, 22, saddles, 23, saddle tie rods, 24, adjustable draft baffles, 25, draft exits 26, recesses in tube holes of upper drum.

General description.—Upper drum 1 which is the water and steam drum and lower drums 2 which are water and mud drums are connected by water tubes 3, forming two oblong sections, each section having a draft exit at each end at or near the top of uptakes 10, making four points of draft to the boiler, said uptakes having adjustable draft baffles located therein. On one side, the draft baffles are shown hanging down. That is the position when the boiler is working economically. The other position shown in dotted lines is the proper position when the operator is blowing the ashes off of the water tubes 3 through clean out door 11. Brick arch 5 will produce a very high furnace temperature to the fire bed on the grate and in conjunction with the brick lining 18 to the end casings and baffle walls 4, help to maintain the high temperature to the gases, until they reach the center of the upper combustion chamber over brick arch 5, where they enter among water tubes 3, and pass back to the draft exit between baffle walls 4 and outer casing 8. While in these passages of which there are four they are caused to move slowly by adjustable draft baffles 24 and by the length of baffle walls 4 are given distance of travel sufficient to cool them down to the temperature of the water in the water tubes and as they cool they drop to the bottom of the section among the tubes and pass out into uptake 10 under adjustable draft baffle 24. The escaping gases under these adjustable draft baffles 24 will be in this boiler about 546 degrees Fahrenheit which is the temperature of the steam at one thousand pounds pressure. This seems high but not when taking into consideration the economy derived by the engine at this pressure and the furnace temperature which should be twenty five hundred degrees Fahrenheit or a little more by the construction of this furnace which will be about five times the temperature of the escaping gases from the uptake which difference will give a boiler efficiency of a little over 80 per cent. The water is kept on the heating surface of this boiler by the circulation, which is caused by the heated gases entering the center of each section, which causes the water to circulate upward through all of the center tubes of each section and down in the tubes at the ends of each section, which causes a very rapid circulation and it is impossible to drive the water off the heating surface as in some other constructions and the steam is taken out of the upper drum over where the water is returning to the lower drum, which al-

ways insures dry steam. The lining bricks 18 in the end casings are secured in pockets cast on the casings. These bricks are made with fifty per cent. saw dust in the clay when molded, which makes the best of non-conducting linings. I have found this lining in conjunction with the dead air space and the asbestos covering with the high furnace temperature to be only warm on the outside asbestos.

I protect both the upper drum and the lower drums from the heat of the furnace by a lining made of two parts fire clay and one part Portland cement which hardens under heat and which I find is the only practical way of making a desirable lining in these positions. Of course the drums in this boiler must be protected from the heat of the furnace as they have to be made so thick from two to three inches according to the size of the boiler, to stand one thousand pounds or more pressure. Preferably I would not build for less than six hundred pounds pressure. I prefer eleven hundred pounds as a working pressure and I prefer to build my drums of a soft cast steel of not less than fifty thousand tensile strength and not less than ten per cent. elongation. On account of the high pressure I cannot build my drums of steel plate riveted together, the usual form of construction. It is also not easy to roll heavy plates to small diameters which I am necessarily confined to, a diameter of three feet being about my limit. I can take steel plate heated and pressed to a form to make my drum in two halves and weld them together but I prefer a soft casting. I could use some alloys but I prefer soft steel casting.

I show holes 16 in top of upper drum 1 for taking tubes 3 in and out of the boiler. When made in this form the upper drum would be hexagon and I would close these holes with brass plugs screwed in, or plates and yokes or other means, or if I did not wish to use this construction I would screw a short nipple in the lower drum then run the remainder of the tube up in the upper drum put a coupling on the nipple, screw the long length down in said coupling and expand said long end of tube in upper drum as shown in Fig. 3. Ordinary expansion on a smooth surface would not do at this pressure. I would cut recesses with a special tool about one sixty-fourth of an inch deep in the tube holes in the drum; about four of these recesses to each inch in thickness and expand the tube either by a roller expander or by having a slight taper and use a taper pin, which would be the proper way in very small boilers. In building this boiler in as small as from fifty to one hundred H. P. I would make the drums in two halves and bolt them together. Also in small boilers from eighteen inches to three feet in height, where the tubes would be about one to two feet long the tubes should only be half inch to three quarters of an inch in diameter and boilers from about four to six feet should be one inch to an inch and a quarter in diameter and from about six to ten feet they should be from inch and a quarter to inch and a half in diameter and in boilers from about ten to sixteen feet in height they should be from inch and a half to two inches in diameter, this being an important factor to produce rapid circulation. If the tubes are too large in diameter for the length, the steam globules will rise through the water to the upper drum without producing any circulation, as the steam globules produce circulation in this boiler on the same principle as the air globules do in lifting water in wells where the water is lifted by compressed air being admitted in a pipe below the water line.

Having described my invention what I claim as new and desire to secure by Letters Patent is:

1. A steam boiler comprising upper and lower drums connected by water tubes, all of suitable material and of proper thickness to carry a working pressure of eleven hundred pounds, all of the tube holes in the upper drum having four or more recesses whereby the tubes may be expanded in said recesses to be capable of standing said pressure, the lower ends of said tubes secured to the lower drums, all necessary parts being protected from the heat of the furnace and the water tubes of proper diameter for their lengths, whereby perfect circulation is obtained by the application of heat, all substantially as set forth..

2. A steam boiler comprising upper and lower drums connected by water tubes, all of suitable material and of proper thickness to carry a working pressure of eleven hundred pounds, all of the tube holes in the upper drum having four or more recesses, whereby the tubes may be expanded in said recesses to be capable of standing said pressure, the lower ends of said tubes secured to the lower drums, all necessary parts being protected from the heat of the furnace and the water tubes of proper diameter for their lengths, whereby perfect circulation is obtained by the application of heat, and the water tubes covered on the outside by fire brick containing dead air space covered with asbestos and the ends of the furnace having a fire brick lining containing dead air space secured to a casing, said casing being covered with asbestos, said furnace containing a brick arch as shown, and uptakes or draft exits containing adjustable draft baffles, all substantially as shown and described and for the purpose set forth.

3. A steam boiler comprising upper and lower drums connected by water tubes, of

suitable material and proper thickness to carry a working pressure of eleven hundred pounds, the upper drum hexagon in form, all necessary parts being protected from the heat of the furnace, and the water tubes of proper diameter for their lengths, whereby perfect circulation is obtained by the application of heat, all substantially as set forth.

Signed at New York in the county of New York and State of New York this 27th day of March A. D. 1909.

ELLIS F. EDGAR.

Witnesses:
E. B. EDGAR,
I. B. EDGAR.